AVIATION WEEK
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MAY 18, 1953
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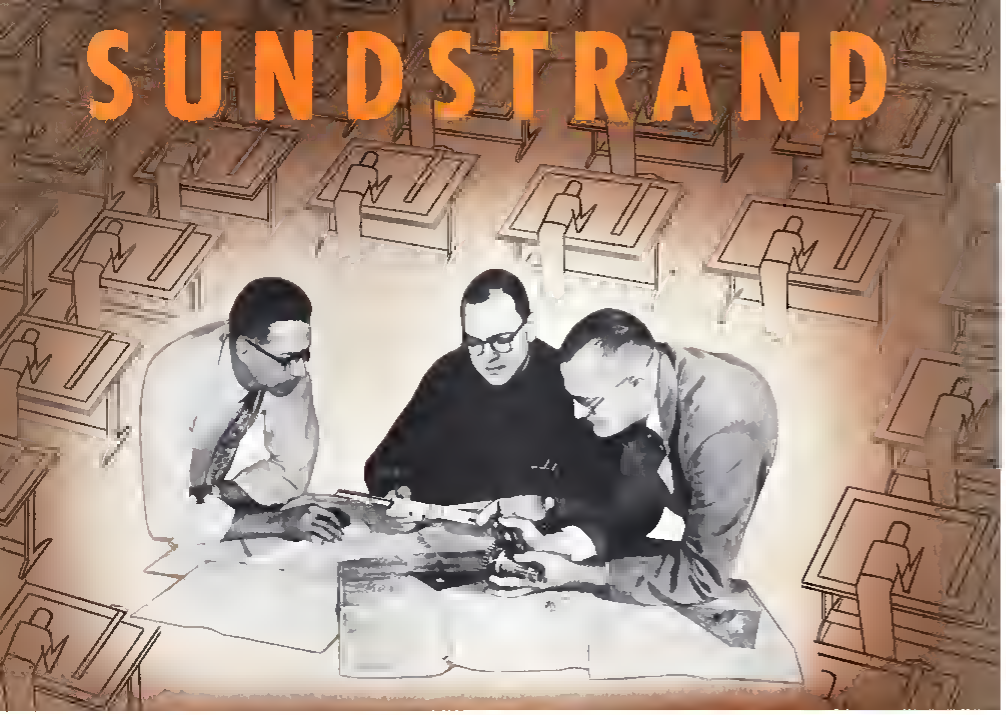

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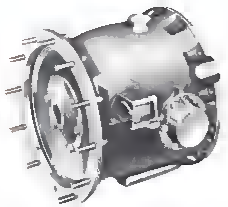

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Aviation Week

Volume 58 — May 18, 1953 — Number 20

Editorial Offices: 330 W. 42nd St., New York 36. Tel. Longacre 4-3000
National Press Bldg., Washington 4, D. C. Tel. National 8-3414

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AVIATION WEEK • May 18, 1953 • Vol. 58—No. 20
Member ABP and ABC

Published weekly by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. Publication Office 99-129 North Broadway, Albany 1, N. Y.

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Nelson Bond, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Director of Circulation.

Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow ten days for change of address.

Subscriptions are solicited only from persons having a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single copies 50¢. Subscription rates—United States and possessions, $8 a year; $6 for two years; $12 for three years. Canada: $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere, $16 a year; $10 for two years; $20 for three years. All other countries: $20 a year; $30 for two years; $40 for three years. Entered as second-class matter July 16, 1947, at the Post Office at Albany, N. Y., under Act of May 8, 1879. Printed in U. S. A.

THREE-IN-ONE REFUELING—Above a Boeing KB-29M Superfortress tanker refuels two Republic F-84s and a Lockheed F-80 simultaneously by Flight Refueling, Inc.'s probe-and-drouge system using three hoses, one unreeled from a streamlined pod at each wingtip of the Superfort, while a third trails beneath its tail. The F-80, using latter hose, has probes in each tip tank, the F-84s have probes in port wings. Similar test in England (photo below, right) shows two nose probe Gloster Meteor 8s using wingtip hoses while a Meteor 4 uses center hose.

Military Jets In Action Here and Abroad

STRAIGHT UP—McDonnell F2H-2P Banshee photo plane (below) of Squadron VC-62, Jacksonville, Fla., pictured climbing straight up. The picture was taken from another F2H-2P. Note the camera windows on side of the photo plane's elongated nose. The F2H-2P is operating from carriers in Korea, usually with an armed F2H acting as escort.

BRITISH JET BOMBER ALOFT—Second prototype Short S.A. 4 is seen on a test flight. Used for high-altitude research, the S.A. 4 has four Rolls Royce Avons mounted in double-deck pods.

The Aviation Week

May 18, 1953

Picture Credits

13 14—USAF 16—NACA 17—(top) Wide World, (bottom) INP 18—Wide World 31—The Aeroplane 39—(top) Boeing, (bottom) Dams 44—(top) Giffels & Vallet of Canada Ltd 3 (bottom) Avro Canada 58 59—Ryan Aeronautical Co 64—PSYA

NEWS DIGEST

NEW F-86H SABRE, flown for the first time at Edwards AFB, Calif., last Monday by test pilot Joe Lynch, is powered by General Electric's new J73 engine rated at more than 9,000 lb. thrust dry. The F-86H is larger and heavier than current Sabres and is designed to operate as a fighter-bomber as well as a day fighter. The F-86H features a clam-shell type cockpit canopy, sturdier landing gear than earlier combat-proven F-86s and improved suspension and release systems for carrying droppable wing tanks, bombs and rockets. Fixed armament consists of six .50-cal. machine guns. All movable horizontal stabilizer on F-86H is larger than previous models. North American Aviation states that the new plane is in the 650 mph. class, has a combat radius of more than 600 mi. and a service ceiling exceeding 45,000 ft. Quantity production is scheduled for NAA's Columbus, Ohio plant.

Explosion Destroys Bell's X-2 Rocket

Bell Aircraft Corp.'s top secret X-2 research rocket plane exploded last week, almost duplicating a blast that destroyed the X-1D two years ago. Chief test pilot Jean L. (Skip) Ziegler and Frank Wolko, flight test engineer, parachuted from the bomb-bay of a B-50 mother plane carrying the X-2, and both were missing.

The explosion demolished the 1,000 mph. experimental aircraft during tests of pressure and rocket fuel systems, prior to launching from the B-50. It occurred at 30,000 ft. over Lake Ontario, and blasted the X-2 loose from the four-engine bomber.

The X-2 plunged into the lake 15 mi. from Rochester, N. Y., but the damaged mother plane limped back to a safe landing at its home base, Niagara Falls, N. Y.

Bell's X-1D exploded and caught fire Aug. 23, 1951, after it was jettisoned from a B-50 over Edwards Air Force Base, Calif.

Domestic

First production models of Pratt & Whitney Aircraft's J57 turbojet engines were delivered last week for installation in Air Force bombers.

New jet trainer built by Ryan Aeronautical Co. would permit interchange of a single Allison 520-C1 engine or two French Mabore 351 powerplants. The Model 59 is rated at a maximum sea level speed of 427 mph., will cruise at 329 mph. (at 35,000). Other data: wingspan, 38.4 ft.; length, 28.04 ft.; empty weight, 3,700 lb.; useful load 2,292 lb.; gross weight 5,992 lb.; rate of climb, 4,100 fpm.; and range, 2.9 hr. or 5.16 hr. with wingtip tanks.

House of Representatives last week voted down an attempt to tack $15 million for new airport construction onto Civil Aeronautics Administration's fiscal 1954 budget. But a strong move to add airport money is underway in the Senate.

Three-cent-a-mile airline service has been promised by North American Air Coach Systems, largest domestic non-sked operator, in testimony before the Senate Small Business Committee.

Civil aircraft manufacturers shipped 339 one- to 10-place utility and executive planes with a total value of $2,752,000 in March, declining from the previous month's figures of 359 at $3,228,000, Aircraft Industries Assn. reports.

Helicopters operated by New York Airways will begin flying mail, parcel post and air cargo twice daily to 12 New Jersey communities between Newark and Trenton June 8, paving the way for planned copter passenger flights.

Financial

Trans-Pacific Airlines announces its first annual profit in seven years of operation, a net of $36,410 for 1952.

Flying Tiger Line has declared a semi-annual dividend of 25 cents a share on preferred stock.

Fairchild Engine and Airplane Corp., Hagerstown, Md., reports earnings for the three month period ending Mar. 31 total $894,000, topping $547,000 made during the first quarter of 1952.

International

Air India C-47 (DC-3) caught fire and crashed in flames shortly after take-off from New Delhi May 9. All 18 persons aboard were killed.

WHO'S WHERE

In the Front Office

C. C. Pearson, who resigned last month as vice president-operations of Glenn L. Martin Co., Baltimore, has joined Beech Aircraft Corp., Wichita, as vice president manufacturing.

C. H. Horne, former CAA administrator, is new air navigation consultant for Bendix Radio Division, Bendix Aviation Corp., Baltimore.

Lt. Gen. Elwood R. Quesada (AF Ret.) has been elected a director of Lockheed Aircraft Corp., Burbank.

Lewis C. Burwell, Jr., has been elected vice president and assistant to the president of Flying Tiger Line. **John P. Goldsmith** has been appointed Flying Tiger superintendent of operations, replacing **John E. Long**, who has resigned to return to duty as an overseas flight captain.

J. H. Overholser has resigned as executive vice president of Hydro Aire, Inc., Burbank.

Louis H. Schuette, vice president in charge of the Hydraulic Division, Sundstrand Machine Tool Co., Rockford, Ill., has been elected a director.

S. Floyd Stewart is new assistant to the president of Jack & Heintz, Inc., Cleveland.

Changes

William Elliott, president Philadelphia Life Insurance Co., **A. King Aitken**, Aitken-Kennett Co., Philadelphia, and **Harry L. Lauer**, vice president Pennsylvania Co. for Banking and Trusts, have been elected directors of Aero Service Corp., Philadelphia.

Hoyt Ammidon, trustee the Vincent Astor Foundation, **Robert E. Blum**, vice president-secretary Abraham & Straus, and **Samuel C. Park, Jr.**, J. H. Whitney & Co., are new directors of New York Airways.

Don R. Wilson has been promoted to assistant to Continental Air Lines vice president maintenance, engineering and operations. **Wayne Lydon** is new director of maintenance and engineering.

Norman C. Taylor has been named assistant chief engineer, Piasecki Helicopter Corp., Morton, Pa.

H. C. Yaeger has been appointed production manager of Jacobs Aircraft Engine Co., Pottstown, Pa.

Alexander Yorinks has been appointed engineering director of Trans American Precision Gear Corp., Flushing, N. Y.

Joseph E. Milheim is new chief engineer of Jack & Heintz, Inc., Cleveland.

Marion E. Jordan, Jr., is new treasurer of Curtiss Wright Corp., Wood Ridge, N. J.

Honors and Elections

Fred M. Glass, aviation director of the Port of New York Authority, has been elected president of the Wings Club, Inc., New York. New vice presidents: **Frederick F. Robinson**, president National Aviation Corp.; **Luis de Florez**, president De Florez Engineering Co.; and **Samuel S. Walker**, Joseph Walker & Sons.

INDUSTRY OBSERVER

► McDonnell Aircraft is flying an XF-88 with an experimental turboprop installation in the nose in addition to two Westinghouse J34 turbojets with afterburners. Turboprop is an Allison T38. The XF-88 takes off and lands using turbojets, with the propeller feathered. Purpose of the experiments is to get data for high-speed turboprop attack plane.

► NACA is experimenting with a trailing edge boundary layer control system to improve performance characteristics of the Chase C-123 transport. Chase also is considering a shift to turboprop powerplants.

► A new lift coefficient indicating device has been developed by Safe Flight Instrument Co. to give a pilot continous readings on how near his plane is to a stall. The device automatically compensates for speed, altitude and gross weight. It is expected to have widespread application in multi-jet military and transport aircraft.

► Watch for a trend toward locating engines under the fuselage well to the rear and shifting horizontal tail surfaces below the aircraft centerline in supersonic aircraft and missiles. Both trends are aimed at reducing the effect of lateral oscillations known as "snaking" at extremely high speeds.

► Watch for a new assault on the world helicopter speed record soon by Piasecki HUP. Frank Piasecki recently said maximum speed of the helicopter now stands at about 150 mph. and can be raised soon to 170 mph. without auxiliary wings or propellers. Present helicopter speed record is 129.47 mph. set in 1949 by a Sikorsky S-52-1 at Cleveland.

► Propellers for the turboprop version of the B-47 are scheduled for early ground testing at Wright-Patterson AFB. Props are newly developed four-blade 15-ft.-diameter units, expected to be teamed with 9,000 hp.-class turboprop engines.

► Aircraft Industries Assn. is organizing a program to determine what further research and development on large forgings will be necessary to assist industry in working with the USAF heavy press program.

► Farey Aviation Co. Ltd. has successfully demonstrated a rocket-powered model of a high-speed delta-wing fighter with vertical takeoff characteristics at the Australian rocket range at Woomera.

► De Havilland Comet 2 prototype logged a ground-speed of 476 mph. on the 2,182 statute mile flight from Hatfield to Cairo on its way to Khartoum for tropical flight testing. This is 32 minutes faster than the best Comet 1 speed over the same route. The Comet 2 is powered by early model Rolls-Royce Avon axial flow turbojets producing better than 1,000 lb. more thrust than the centrifugal Ghosts on Comet 1.

► Italy will get an undisclosed number of Fairchild C-119 Flying Boxcars under the MDAP program. Belgium already has received C-119s from MDAP.

► Sikorsky will use a four-blade rotor in its enlarged S-55 anti-submarine warfare configuration, designated the S-58. The twin-engine S-56 will use a five-blade rotor which will function satisfactorily with one complete blade shot away. This rotor configuration is expected to reduce the vulnerability of the S-56 to enemy ground fire. Its principal use will be as a Marine assault transport.

► Glass-reinforced plastic airframe structures are under study at Douglas Aircraft. Company is reported adapting the material in an experimental project involving the DC-4 wing from the outer nacelle to the wingtip.

► Probably the largest single application of titanium alloys in an airframe will be in Republic Aviation Corp.'s F-103, in which about 90% of the construction is said to specify the new materials. Project should uncover and resolve a lot of processing problems this large-scale usage will involve.

Washington Roundup

Budget Surprise

Everyone in the Pentagon expected a substantial cut in the fiscal 1954 military budget, but virtually all were surprised on two counts when the revised budget was submitted to Congress last week.

- Size of the cut: More than $5 billion.
- Where cuts were deepest: Most of the reduction was squeezed out of the Air Force and Naval air power.

▶ **What Is Happening?**—Few Pentagon insiders have a clear idea of what is behind the Eisenhower military budget cuts or why air power was nominated for the axe. Army got a slight increase in funds, mostly for accelerated ammunition production—aftermath of the Korean ammunition shortage scandal.

▶ **Washington Guessing**—Best guess at this time is that the action is simply a strong political inspired move to make an economy showing for the Republican Administration. Some Republican senators are screaming for even larger defense cuts.

Best guess as to why air power took the rap: It is the largest single bloc of money in the defense budget and therefore the easiest in which to make a quick, large cut.

Administration also is counting on large obligated but unexpended carryover funds from previous years' appropriations to keep aircraft production going for the next 18-24 months. The plan is to give the individual services a money and manpower ceiling and let them wrestle with the details of how they use them. USAF now will get $11.6 billion, with a manpower ceiling reported at 915,000—about 60,000 below the present Air Force level.

There has been bitter debate in the Air Council over how to make the necessary cuts. Retiring Chief of Staff Hoyt Vandenberg has warned against impairing the basic security of the United States by cutting Strategic Air Command and Air Defense Command. Some top USAF brass are willing to scrap Tactical Air Command, troop carrier outfits and cut MATS to the bone to save SAC and ADC.

▶ **Talbott's Position**—Air Force Secretary Harold E. Talbott has made no public statement on the air power cuts, but it is likely that he will go along with Republican party policy on them and risk no official wrath such as descended on Sen. Stuart Symington when he was Secretary and bitterly opposed a similar Democratic economy move.

▶ **Kyes Key Man**—The defense budget hassle has left no doubt in the Pentagon about who is running the Wilson show. It is Roger Kyes, Wilson's undersecretary and long time General Motors Corp. associate.

Atomic Slowdown

Pentagon won't say a word officially, but there is little doubt now that the development of atomic power for aircraft will slow to a shuffle. The Convair-General Electric project which called for building an actual test atomic engine and a flying test bed to carry it aloft will be cut back to a study project.

The Boeing Pratt & Whitney Aircraft project to investigate the feasibility of an atomic-powered tactical aircraft still is in the study stage—probably won't go farther under present Defense Department regime.

Industry sources scoff at the idea advanced by some top Pentagon civilians that atomic aircraft research will accelerate if the government withdraws financial support. Aircraft industry is in no position to finance atomic development privately. One large private corporation with extensive interests outside aviation recently turned down a Navy gas turbine development project because Navy wouldn't furnish $40 million worth of brick and mortar for test and development facilities.

Missile Row

Watch for the next inter-service squabble to flare up publicly over who will do what with guided missiles. It already has produced some sizzling sessions of the Joint Chiefs of Staff, with the Army attempting to edge into the strategic bombing mission by claiming that long-range guided missiles are simply an extension of artillery and should be controlled by the Army. USAF and Army also are scrapping over who should have responsibility of anti-aircraft missiles. British recently settled a similar row by giving the Royal Air Force control over all guided missiles.

Wanted: A Sponsor

Proposed dissolution of the Munitions Board creates a new problem for the aviation industry. It will eliminate the sponsor for the joint Air Force-Navy-civil program on aircraft design criteria and for the aeronautical standardization program administered by the Aeronautical Standards Group.

Pentagon and industry sources familiar with these projects feel that both programs are essential and worth more than they cost as assurance of better aircraft produced cheaper. But just what organization will take over, when Munitions Board and Defense Supply Management Agency go out of existence according to plan, is still quite vague.

The programs could be carried out by some association of representatives of the Air Force, Navy and CAA, without a coordinating Defense Department sponsorship, but at a considerable price in efficiency, industry spokesmen say. The main need for a Defense Department sponsor is to supervise and finance the issue and revision of joint bulletins to industry. Probably the best known of the design criteria bulletins is ANC-5, strength of metal aircraft elements.

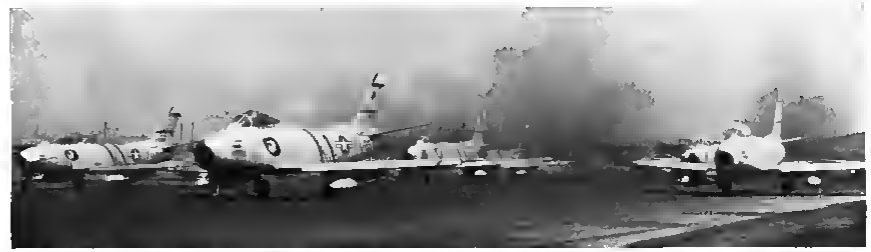
Others are ANC-17, dealing with aircraft plastics, and ANC-23, dealing with "sandwich" aircraft construction.

These bulletins, prepared with industry help and advice, have frequent amendments to keep them up to date. And revised editions are issued every two-to-three years. They have performed a function of considerable assistance to the aircraft industry, sources within the industry say. With the growing requirements for precision of manufacture at the higher aircraft speeds now commonplace, uniformity of criteria from which to work has become indispensable. Similarly importance of continued work on standardization is being emphasized.

If the U. S. aviation industry is to keep abreast of new changes and developments in materials, and is to make further economies in manufacture through standardization, the continuity of the design criteria, and the standardization projects need to be maintained. Industry sources are looking to the Defense Department to come up with some feasible alternative to maintain this continuity before the Munitions Board goes down for the third and last time.

—Washington Staff

AVIATION WEEK VOL. 58, NO. 20 MAY 18, 1953



USAF F-86s get set for a sweep into MiG Alley where they have been encountering captured Sabres flown by Communist pilots

Exclusive Frontline Report

Reds Fly Captured Sabres in Combat

U.S. Fliers Report Attacks; Communists Now Hold Secrets of F-86 and Its Radar Gunsight

By William J. Coughlin

Seoul, Korea—Communist pilots have been flying captured F-86s in combat against American Sabre jets in MiG Alley. This means Air Force's first-line fighter, with its radar gunsight, is compromised.

Use of American Sabres in combat by the Reds has been rare, but on several occasions U. S. fighter pilots have reported firing attacks by a Communist-flown F-86, usually in company with Russian-built MiGs.

On one occasion the Sabre was reported as flying wing on one of three MiGs in a four-ship flight. In another attack, the Sabre was leading a MiG on an element of two.

It is believed the Reds have more than one F-86 in flying condition and that Communist-flown Sabres encountered by American pilots in MiG Alley have not always been the same plane.

▶ **Red Advantage**—The incidents, which recall occasional use of captured Allied aircraft by the enemy in World War II, emphasize again an advantage which the Reds hold in the Korean air war.

- MiG Alley fighting is entirely over Communist territory.
- Red planes and pilots fall into friendly hands when shot down.
- American planes and pilots drop into enemy territory.

Thus, a number of Sabre jets have crashed in the area near the Yalu River. It is not surprising that the Reds have patched some of them up to fly again.

▶ **Capture Gunsight**—Presumably, Communists also have the secret radar gunsight which has helped give U. S. pilots a terrific edge in the Korean fighting. How fast they will benefit from this is a matter for debate.

One expert on the sight says that even with the device in their possession, it will take the Reds at least a year to discover the secret of its operation. Others, pointing out the Russians and their German scientific advisers undoubtedly have been at work on such a device, say examination of the sight may provide the missing clue that would bring rapid Russian production of a similar gunsight.

▶ **MiG Lessons**—Compromise of the North American Aviation jet fighter was a risk the Air Force took when it committed the Sabre to combat in Korea. The Communists now have the Sabre in their possession. What, in return, has U. S. learned about the Russian-built MiG-15?

U. S. has captured no MiGs in Korea which would fly, has in fact salvaged only one non-flyable MiG. But Air Force has learned a great deal about the Russian fighter by meeting it in combat.

- Air battles over the Yalu revealed how the MiG stacked up against U. S. Sabre in performance, gave a strong line on the direction Russians were moving in the search for a superior fighter.
- Red tactics in Korea shed light on Communist fighting technique, disclosed to a limited extent how Communists are making use of their air power.

Putting this information together with details on MiG construction and equipment obtained from the aircraft salvaged in Korea and from the fugitive Polish MiG which landed in Denmark, American designers can obtain a pretty clear picture of the plane—mainstay of the opposition.

▶ **Transonic MiG**—Russia is expected to produce a number of supersonic aircraft within the next 10 years which may be on a par with heavyweight U. S. F-100s, F-101s and F-102s.

But it is a modified transonic MiG which U. S. air experts say will make up the bulk of the Soviet air force during that period. Therefore, information on the MiG is considered of highest importance.

Here, in brief, is how the Russian-built fighter stacked up performance-wise with American F-86 Sabre in MiG Alley:

- Top speed (level flight). Very slight advantage to the F-86 below 20,000 ft., increasing advantage to the MiG above that altitude.
- Dives. Definite edge to F-86 above Mach .95 at all altitudes. Equal at lower Mach numbers.
- Rate of climb. Definite advantage of the MiG which can maintain such high climb angles that Sabres will stall when trying to follow.
- Ceiling. Definite edge to MiG. U. S. pilots have reported MiGs holding

AVIATION WEEK'S BILL COUGHLIN (left) interviews Lt. Warren Morgan of the 4th Fighter Interceptor Wing at an F-86 base near Seoul, during a recent trip to the combat zone where he gathered material first hand on USAF operations in that theatre.

formation above 50,000 ft., Sabres have trouble at 45,000.

• **Turns.** Until a year ago, F-86 held slight advantage below 30,000 ft., MiGs had edge above that altitude. At that time, an improved MiG demonstrated it could outturn Sabres at all altitudes. A design improvement has returned advantage to the Sabres.

Recently there have been indications the MiG suffers from a reversal of control in a high-speed stall which causes the Russian fighter to snap out into a spin. Several U. S. pilots report MiGs have spun in from high altitudes due to apparent inability to recover in this situation.

• **Rate of roll.** F-86 now has definite advantage at all altitudes and all speeds.

• **Acceleration.** MiG holds substantial edge at all altitudes and speeds.

• **Deceleration.** Although MiG has an initial deceleration advantage, F-86 has overall edge, apparently due to fact that Sabre speed brakes open slower than MiG brakes but are more effective in operation.

• **Structural load limits.** Until a year ago, F-86 held decided advantage, because the Reds did not impose high load factors on MiGs that U. S. pilots did on Sabres. Reds evened this advantage somewhat a year ago apparently as a result of boosted controls.

MiG Alley Combat

How do the Communists fight with the MiG? No correspondent can go with the men who take the Sabres into MiG Alley. But when the pilots return to the fighter bases, they talk of their opponents, illustrating with the characteristic hand gestures.

"When we jumped the flight, one element fanned high and the other went low. We went after the low MiGs but before we got close enough to clobber them, the other element came back at us from 6 o'clock and we had to break off."

That is a favorite defensive maneuver of the Reds. Under attack, one element zooms high and away from the closing Sabres while the other element goes into a shallow zoom in the opposite direction. The high element does not always re-engage but sometimes climbs away from the fight. A two-ship element of MiGs often will use the same split maneuver when attacked.

► **Superior Climb**—A climbing turn, taking advantage of superior rate-of-climb, is the most common defensive maneuver of the individual MiG. The MiG pilot has learned never to dive away from an attacking Sabre, which holds the edge in a dive.

"They were criss-crossing above us, waiting for an opening before coming down. We were pacing them off to one side and below, going in the same direction, waiting for them to jump us."

► **Altitude Advantage**—The Reds, aware of the altitude limitation of the F-86, consistently use their ceiling advantage to dive down on the Sabres in a quick attack and then climb back out of range.

Under these circumstances, the Sabre pilots have no choice but to keep their speed high, maneuver to keep the Reds from obtaining an edge in the initial attack and wait for the fight to begin.

► **Rear Attack**—Favorite MiG attack is a boxing maneuver with a flight high and on each side of a flight of Sabres. When the F-86s break to meet one flight diving to the attack, the other MiG flight jumps the Sabres from the rear.

While Communist pilots usually do not shy away from a head-on pass, they prefer a stern attack. One offensive maneuver often used is a line-abreast dive with all MiGs in the attacking flight firing from a 5 o'clock to 7 o'clock position. A variation of this is a dive far behind a flight of Sabres with the attack coming in a slight zoom.

Another Red maneuver is both offensive and defensive. When an element of Sabres forces two MiGs into a turn, the MiG leader will go high around the turn and his wingman level. If the Sabres follow the low MiG, the other Red pilot is soon in a position to attack the Sabre element from above. If the F-86s break into the high MiG, both Communist pilots usually climb away from the fight.

Reds use both the four-ship fingertip formation employed by USAF and the RAF "finnd six" formation. Two-ship element is basic.

► **Electronic Edge**—Sabre pilots at times can see MiGs take off from bases in the Antung complex, form up north of the Yalu and come south across the Manchurian boundary into North Korea. Reds have advantage of good GCI (Ground Controlled Intercept) direction, which can vector them toward or away from Sabres as desired. Due to location of the combat zone far north of U. S. lines, American pilots have no such electronic assistance.

Early in war, F-86s patrolled MiG Alley in large formations while screening fighter-bombers striking farther south. But Air Force discovered Reds were following American formations on radar, vectoring MiGs across the river at unprotected points to hit the fighter-bombers. U. S. airmen changed tactics, began patrolling in scattered flights of four breaking into the area from different directions. This cluttered Red radar and set up a more effective fighter screen. Disadvantage: It meant Sabres were almost always out-numbered when meeting MiGs.

"I heard Charlie call that his flight had jumped some MiGs at 40,000 at Sinuiju. I was at 40,000 at Sinuiju, and I'm damned if I could see them."

► **Tougher Than World War II**—Fighter pilots agree that the combination of high speed and high altitude make visibility a very difficult problem in MiG Alley and make the fighting tougher than any in World War II. As one pilot put it: "If you're not in a fight when it starts you just don't get in it because you usually can't find it."

MiGs usually dive into the area in offensive trail formations without lateral deployment for defense since, generally, they are above the Sabre ceiling. Size of flights may be from four up to 30, depending upon the total Red air effort for the day. As many as 200 MiGs have been committed at one time. (Formations of 75 ships have been seen at altitudes above 40,000.) When a large effort is mounted, three groups of up to 30 MiGs each may come south in trail, stacked down from the lead group with about 1,000 ft. separation vertically and 3,000 horizontally. The Reds seldom stack flights up.

Red pilots generally fly tighter combat elements than Sabre pilots.

► **Straggle Maneuver**—Descriptions of Communist formations vary from "very good" to what one observer described as a "casual aerial gathering."

"We jumped a big formation from what we thought was the rear but were nearly clobbered by about 15 MiGs straggling alone behind us."

This is a hazard of attack on one of these loose formations which straggles out on the end so much that it is difficult to discover just where one flight ends and the next begins. When one of the large indefinite formations is in a turn, it is unusually difficult to attack. Some of the MiGs go high on the turn, others swirl low, while some take the middle. Thus any one MiG pilot is protected by others abreast of him. While probably not planned, the straggle is an effective maneuver.

Knowledge of the MiG and its pilot gained in Korean combat has been considerable. American airmen have found their opponents often aggressive with improving air discipline and adaptable tactics. But U. S. strategists believe employment of the MiG has not been as effective as possible. Our fliers agree the Russian fighter is not as good an air weapon as the Sabre. But one thing USAF has learned about the MiG can be put down as a certainty: To a man, U. S. fighter pilots are sick of looking up at the bottom of it.

UAC Reports Top Officers' Salaries

United Aircraft Corp., East Hartford, Conn., paid president H. Mansfield Horner $157,240 in salary during 1952, UAC reported to the Securities & Exchange Commission last week.

Frederick B. Rentschler, board chairman, received $107,600, Leonard S. Hobbs, vice president engineering, received $115,800, William R. Robbins, vice president and controller, received $93,619, and Raycroft Walsh, vice chairman who died Aug. 17, received $39,250.

Air India Grounds Vikings

(McGraw-Hill World News)

Bombay—Vickers has asked airlines operating in India to ground Viking transports with more than 8,000 hr. flight time following an accident in Africa believed to be caused by metal fatigue.

Defense Fight

- **Congress opposes new plane procurement cuts.**
- **Budget slashes will delay buildup of USAF wings.**

The President's decision to slash $4 billion from Air Force and Navy aircraft procurement funds for fiscal 1954 touched off stormy opposition in Congress and began a major controversy to be threshed out at this session.

Cut would slow the buildup of USAF wings, so there would be only 110 by mid-1954, instead of the programmed 130, toward the ultimate goal of 143.

► **Crippling Blow**—First battle will be in the House Appropriations Committee, which opened hearings last week promptly after the revised Eisenhower defense budget was submitted.

Rep. George Mahon, ranking Democrat on the Armed Services Subcommittee, opposes the big cut in funds for plane purchasing as a crippling blow at U. S. defense strength and world prestige. A veteran at handling defense money, Mahon says that with maximum efficiency and economy, an outside of $1 billion can be saved in the defense budget but that deeper cuts simply mean less defense.

Appropriations Committee chairman Rep. John Taber would like to slice more from the $36.2 billion defense budget proposed by the President—$5.2 billion less than the $41.4 billion recommended by the Truman Administration.

► **Impact on Industry**—What the Eisenhower defense budget would mean to the aircraft industry:

• **Sharp letup in contracting.** The budget includes only $4.9 billion in new money for Air Force and Naval Aviation aircraft and related procurement. This is less than a third of the $17.6 billion the two services have available for the current fiscal year.

• **Stretchout of production.** The President's directive to hold defense spending in fiscal 1954 to $43.2 billion hits the aircraft program hardest. On July 1, start of the new fiscal year, USAF and Navy will have a backlog estimated at $25 billion in aircraft and related procurement orders and will be set to go but new ceiling, delivery schedules must be slowed down.

• **Research and development slowdown.** The Eisenhower budget recommends $475 million to USAF for research and development—$62 million less than $537 million recommended in the Truman budget. This year's allocation: $530 million.

• **Machine tool buildup.** The new budget recommends $500 million to build up an industrial reserve of machine tools and facilities, the same amount which was recommended in the Truman budget.

• **New aircraft carrier.** Although shipbuilding funds were cut deeply in the Eisenhower budget, Navy is giving top priority to a third Forrestal-class carrier and will fit it into the $938 million allowed.

This is how the Eisenhower budget slices the $36 billion Defense Secretary, $1 billion; Army, $13.7 billion; Air Force, $11.7 billion; Navy, $9.6 billion.

It reflects a $5 billion slash for USAF, a $1.7 billion cut for Navy from the Truman budget, and a $1.5 billion increase for the Army to include money for carrying on its share of the Korean fighting.

Outlook in the debate over air power funds is for a split down party lines, with Republicans supporting the cuts in the budget and Democrats opposing them.

Aviation Executives Review Airport Aid

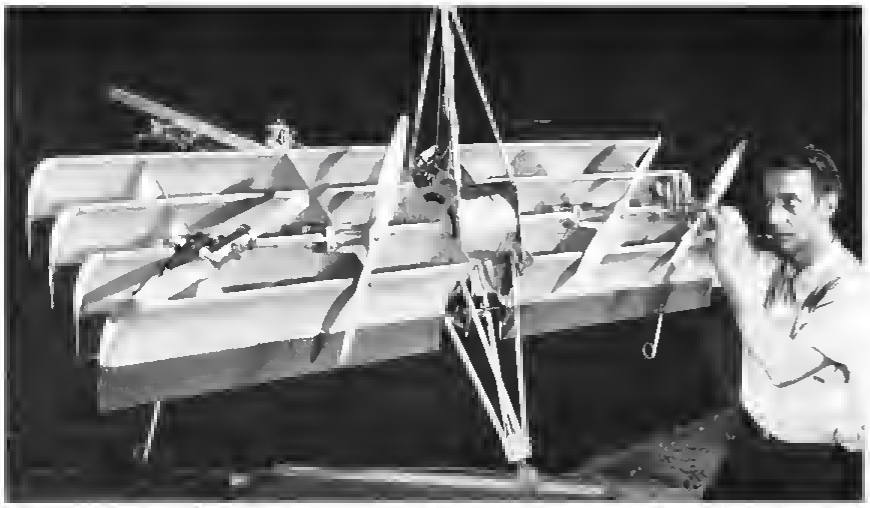
The federal airport aid program, already under fire, is slated for a "thorough review" by a 13-man group of aviation industry executives. Undersecretary of Commerce for Transportation Robert B. Murray, Jr., has organized the study group in Washington. Jennings Randolph, assistant to the president of Capital Airlines, was elected chairman.

Randolph says the group intends to make a careful study of the history and present status of the airport aid program and incomplete projects.

The group will hold its second meeting next month at Commerce Department.

Melvin H. Nuss, Reading, Pa., treasurer of American Assn. of Airport Executives, is secretary.

Other members: Brig. Gen. Milton W. Arnold, Air Transport Assn.; Francis A. Bolton, Port Columbus Airport, Columbus, Ohio; Jean H. B. Dubuque, Corporation Aircraft Owners Assn.; Washington J. D. Durand, Air Transport Assn.; Louis R. Inwood, Division of Aviation, Philadelphia Department of Commerce; Foster V. Jones, Louisville and Jefferson County Air Board, Louisville, Ky.; A. B. McMullen, National Assn. of State Aviation Officials, Montpelier, Vt.; Donald W. Nyrop, Conference of Local Airlines, Washington, and former CAB chairman; R. W. F. Schmidt, Tucson (Ariz.) Airport Authority; Thomas K. Taylor, Trans World Airlines, and J. B. Hartranft, Aircraft Owners and Pilots Assn., Washington.



"VERTICAL RISER" model is being tested by NACA as part of its research program on convertiplane hovering stability problems

Transonic Data Demands Swamp NACA

By Robert Hotz

Langley Field, Va.—Demands of the aircraft industry for transonic research data to design military planes and missiles have swamped the limited high speed research facilities in this country, according to officials of the National Advisory Committee for Aeronautics.

In outlining highspeed research progress at the biennial military industry inspection of the Langley Aeronautical Laboratory, NACA officials said military requirements for aircraft and missiles are so close to the frontiers of aeronautical research that there no longer is any time lag between acquisition of research data and its application to specific aircraft designs.

► **Unpredictable Mixture**—NACA reported the bulk of problems facing aircraft designers today lies in the transonic range where an unpredictable mixture of subsonic and supersonic airflow make mathematical analysis impossible, forcing complete dependence on windtunnel and flight test data.

Aircraft designers attacking these problems must operate with a precision never before required, NACA says, because even minor variations in supersonic designs can mean a speed difference of several hundred miles an hour. The problem is complicated further because it hasn't yet been determined to what extent detailed information about one highspeed design can be successfully applied to other.

► **Insatiable Demand**—NACA now operates at Langley the only three truly transonic windtunnels known in the world. But the committee reported that even if funds and staff were available to operate the tunnels at full capacity, they would be unable to supply the demand from the aircraft industry for a "seemingly insatiable" amount of transonic experimental data.

As an example of how hard pressed researchers are to meet these demands, NACA officials revealed they had revised the role of the research aircraft that made original explorations of faster-than-sound speeds and are using them to test specific design features aimed at alleviating the worst problems likely to be met by military aircraft in the turbulent transonic range.

NACA detailed how the Douglas Skyrocket (D 558-II) had been altered to test these specific design features:

• **Leading edge wing slats.** This device has long been used to improve lowspeed stability of sweptwing aircraft. The Skyrocket is exploring its influence at transonic and supersonic speeds.

• **Leading edge wing extensions.** When extended, these devices add to the chord of the wing. Their influence on highspeed-stability problems is being determined from Skyrocket flight data.

• **Wing fences.** These were added to one side while decreasing it on the other. Yaw control is obtained by moving wing flaps so that slipstream is directed backward on one side and forward on the other. A rate-sensitive artificial stabilizing device to provide additional damping in pitch has been installed to prevent unstable pitching. Four pilots are required to operate this research device—one for each variable propeller and one for each set of flap controls.

• **Hydroskis.** NACA has developed a new hydroski shape that combines maximum water lift with the ability to retract flush with the fuselage of high speed aircraft.

• **Ditching.** Ditching research has been extended to jet and sweptwing aircraft. Tests indicate sweptwing planes generally have good ditching characteristics, but jet bombers are vulnerable in weak portions of their belly structure—such as bomb bay doors and wheel wells. The B-45 exhibited dangerous porpoising effects due to bomb bay door failure on impact. The B-47 jet engine pods broke off on impact, and the fuselage showed generally good ditching form. NACA has tested a type of retractable hydroski designed to improve ditching characteristics of commercial airliners. Boeing C-97 confirmed its designers predictions of excellent ditching form landing in the NACA tanklike flying boat.

• **Landing gear.** NACA is conducting basic research on methods of reducing landing gear weight which has crept up to 24% of total aircraft structure on some types of heavy jet aircraft. The committee is building a special landing gear load test facility, has instrumented a B-29 to obtain landing load data and is making movie studies of normal commercial transport operations in order to obtain data on aircraft sinking speeds.

Crash Fires

National Advisory Committee for Aeronautics reports progress in development of equipment that effectively will prevent fires ignited by engines during aircraft takeoff and landing accidents.

NACA experimental equipment, which did not attempt to solve the weight and bulk problems inherent in military and commercial aircraft, consisted of three elements:

• **Electrical wipe-off switch** that cuts out the electrical system at the moment of crash impact.

• **Carbon dioxide discharge** into the engine induction system.

• **Water-spray system** that discharges cooling water onto hot portions of the engine exhaust collector ring and stacks.

Movies of the NACA crash fire research at its Lewis Memorial Laboratory show this equipment is successful in preventing crash fires from normal engine sources. However, other previously hidden ignition sources are disclosed, including static electricity charges that build up on broken and scattered components, such as landing gear struts, jet engine pods and hot friction sparks generated as metal aircraft parts skid along concrete runways.

NEW TOP BRASS

Recent military appointments made Gen. Nathan F. Twining (above photo, left) Air Force Chief of Staff succeeding Gen. Hoyt S. Vandenberg while Adm. Arthur W. Radford (photo right) was named by President Eisenhower to succeed Gen. Omar Bradley as chairman of the Joint Chiefs of Staff. Twining is seen being congratulated on his promotion by Air Force Secretary Harold E. Talbott (right) while Lt. Gen. Thomas D. White named to take Twining's former post as Vice Chief of Staff, watches. Gen. Vandenberg is retiring June 30. The new Air Force chief is 56 and is scheduled for retirement in October, but will be recalled to active duty to serve the remainder of the two year term of Chief of Staff. Adm. Radford is 55 and figured in the B-36 inquiry. A qualified pilot, he previously was Commander in Chief, Pacific Fleet.

Committee Cuts CAA Budget

Making some cuts on its own, House Appropriations Committee went further than the recommendations of the Eisenhower Administration and slashed more than $60.2 million from Civil Aeronautics Administration's fiscal 1954 budget.

The Truman Administration recommended $200.2 million for CAA the new Administration, $140.9 million and the House Committee, $139.9 million.

Approval of the Appropriation's Committee recommendation would reduce CAA's budget to the lowest level in recent years. CAA's current budget is $149 million. In fiscal 1952, it was $165 million, in fiscal 1951, $213 million, and $212 million in fiscal 1950.

Under budgets proposed by the Eisenhower or the committee, CAA personnel would have to be reduced by close to 400.

The committee allowed $105 million for administration and general operations—the amount earmarked this year and last year for salaries and expenses. The Truman budget recommended an increase to $110 million.

Following Administration recommendations, the Appropriations Committee eliminated $30 million for new airport construction, killed $13 million proposed for establishment of new air navigation facilities and reduced funds for air navigation development from $4 million to $1.5 million. The House group followed another Administration recommendation, cutting out $1.6 million for an additional Washington airport.

The committee trimmed Civil Aeronautics Board's budget for fiscal 1954 to $3,750,000, slightly less than the $3.8 million CAB has this year. The Truman budget proposed $3,950,000, the new Administration recommended $3.8 million.

Cochran Sets Sights On 700-Mph. Record

Jacqueline Cochran plans an attempt at a new world's jet aircraft speed record, flying an Orenda-powered, Canadair-built F-86E Sabre at Edwards AFB, Calif., within the next week.

Miss Cochran recently became a member of the flight test advisory staff of Canadair Ltd., subsidiary of General Dynamics Corp. Her husband, Floyd Odlum, last week was retiring as chairman of the board of Consolidated Vultee Aircraft Corp. after Atlas Corp., which he heads, sold 400,000 shares of its CV stock to General Dynamics.

The woman speed flyer has been training for the world record attempt in Lockheed T-33 jet trainers and USAF Sabres at Muroc Dry Lake Air Field.

Earlier plans for the flight were delayed by a recent illness. Reports indicate it was not serious.

Reports from Edwards AFB say the course planned is a closed circle, which will involve 3G turns, indicating Miss Cochran will not be challenging at this time the straightaway world's speed record set by USAF Maj. J. Slade Nash last November. He flew a North American F-86D 698.5 mph. at Salton Sea.

Miss Cochran holds the national women's speed record for propellor driven planes of 464.374 mph., flown in a North American F-51 Mustang at Indio, Calif., in April 1953. The women's jet speed record is held by Jacqueline Auriol of France, who flew a de Havilland Vampire 508.393 mph. in May 1951.

FRENCH UNVEIL NEW MISSILE

First photo of new French Matra M.04 missile that has exceeded 1,100 mph. speed during tests at a North African test range (Aviation Week Apr. 20, p. 18). It is approximately 14 ft. long and weighs 920 lb. M.04 currently is air launched, but plans are underway to have it fired from the ground. A single SEPR rocket which produces 2,750 lb. thrust is employed to power the missile.

Bell Aircraft Officer Buys 4,500 Shares

Forty-five hundred shares of Bell Aircraft Corp. common stock were purchased by Ray P. Whitman, officer and director, through a stock option agreement, Securities & Exchange Commission reports in a summary of March security transactions and holdings.

At month's end, Whitman owned 5,500 common shares of Bell stock. In the same month, Walter A. Yates, director, sold 100 common shares leaving him 1,836 shares.

Other aviation stock transactions in March:

Air Associates Inc.: William H. Foulk director bought 100 shares of common making a total holding of 300 shares.

Airferia, Inc.: George Lusk officer sold 200 shares of common leaving a total holding of 407 shares.

American Airlines: W. Nelson Bump officer sold 100 common shares, leaving a total holding of 400 shares.

Aro Equipment Corp.: Ralph A. Bard director sold 800 common shares leaving a total holding of 2,000 shares.

Avro Manufacturing Corp.: R. S. Pruitt officer and director sold 5,400 common shares leaving a total holding of 26,270 shares. Judson S. Sayre officer received 500 common shares as compensation making a total holding of 14,000 shares. Kendrick R. Wilson Jr. officer bought 400 common shares making a total holding of 500 shares.

Bellanca Aircraft Corp.: Mrs. N. F. Vanderlipp wife of a corporation officer bought 200 common shares beneficially her total holding.

Capital Airlines: Charles H. Murchison director bought 1,000 common shares, making a total holding of 12,000. Arthur F. Kroegrr director bought 300 common shares making a total holding of 500 shares.

Crosno Aircraft Co.: F. A. Boettger officer and director sold 2,000 common shares leaving a total holding of 5,000. Dwane L. Wallace officer and director sold 3,000 common shares leaving a total holding of 89,500.

Chicago & Southern Air Lines: T. F. Hembleton officer sold 100 common shares his total stock.

Colonial Air Lines: Francis Hartley Jr. director sold 3,100 common shares, leaving a total holding of 3,106.

Consolidated Vultee Aircraft: Lamotte T. Cohn director bought 300 and sold 200 common shares, leaving total holdings of 600 shares. Leland W. Miller officer bought 100 common shares, making a total holding of 2,400 shares.

Continental Air Lines: F. H. Rickrison director bought 200 common shares making a total holding of 5,000 shares.

Fairchild Engine & Airplane Corp.: George P. Cuppline officer sold 600 common shares leaving a total holding of 100.

Flying Tiger Line: William E. Harding officer sold 200 common shares leaving a total holding of 188.

Lockheed Aircraft Corp.: Daniel J. Haughton officer sold 400 capital shares leaving a total holding of 1,300 shares.

Glenn L. Martin Co.: William Bareis Harding director sold 400 common shares leaving a total holding of 400.

National Aviation Corp.: Frederick F. Robinson president sold 100 common shares leaving a total holding of 100 shares.

Northwest Airlines: D. J. King officer sold 400 common shares in February his total holdings.

Seaboard & Western Airlines: Carl D. Brell officer bought 1,100 common shares making a total holding of 31,425. Arthur V. Norden officer bought 3,000 common shares making a total holding of 34,921 shares.

ICAO Plans New Transport Yardstick

New national and international yardsticks for transport aircraft performance are moving toward approval at a Paris meeting of the International Civil Aviation Organization's standing Committee on Performance.

The five-week session, fourth meeting of the international committee in two years, is expected to be the last before the new proposed standards are presented for divisional approval at an ICAO conference in Montreal next March.

▶**U. S. Criticism**—The sessions are being watched closely by American aviation interests because of mounting criticism in the U. S. of existing performance standards and their failure to take into account scientifically all variables involved in aircraft takeoff, climb, cruise, descent and landing.

This criticism was aired recently by the Air Line Pilots Assn. in discussions of gross weight limitations of such airplanes as the Convair 240, Boeing Stratocruiser and Martin 4-0-4.

New performance standards are designed to take into account laws of probability for various types of incidents and to adjust performance requirements by mathematical formulae to hold the probability of such incidents within desired frequency levels. The probabilities are based on actual airline records of flight experience.

▶**Parallel Adoption**—Ray Maloy, Civil Aeronautics Administration Flight Test Branch chief, is head of the U. S. delegation, which includes Ed Koneczny and Hugh Freeman, both of Civil Aeronautics Board Safety Regulation Bureau. John A. Curran, CAA, Flight Test Branch, and F. Stanley Nowlan, United Air Lines. The same group is working up a parallel set of performance requirements for U. S. federal adoption, with a view to national and international standardization on performance of transports.

If the Paris committee completes its work as anticipated, some U. S. airlines are planning to work out trial applications of the new standards on paper this summer, applying them to transport planes now flying on specific routes and considering actual runway lengths, altitudes and temperatures encountered in flights. This will provide further experience data before the divisional meeting next March and final ICAO approval.

Capital Boosts Pay Of All Its Officers

Capital Airlines has reported to the Civil Aeronautics Board that all top officers last year were granted salary increases ranging from $500 to $4,000. Some officers increased stockholdings, picking up their 1948 options at $5.50 per share, about half the current market price.

Here are Capital officers' and directors 1952 compensation and holdings of common stock and debentures as of Dec. 31, 1952, with comparable 1951 figures shown in parentheses where changes occurred.

J. H. Carmichael, president and director, salary $48,000 ($44,000), common stock shares 3,000 (4,637); R. G. Lochiel, vice president, treasurer and director, salary $30,000 ($28,600), shares 3,915 (2,715); James W. Austin, vice president, salary $28,000 ($26,400), shares 6,400 (6,300); James B. Franklin, salary $26,000 ($24,750), shares 4,000; Robert J. Wilson, vice president and director, salary $22,250 ($21,780), shares 1,400 (1,500); Hayes Dever, secretary, salary $17,500 ($17,050), shares 200 (100). Charles H. Mur-

CANADIAN SABRE BARES ITS TEETH

A Canadair-built F-86E Sabre jet fighter makes impressive sight during firing of its six .50-cal. machine guns at night on an armament range in Canada. Three hydraulic jacks are visible, one under the nose and one by each main wheel.

chison, chairman of executive committee and director, salary $18,000 ($16,500), shares 11,000 (10,300).

Other compensation in excess of $10,000 was $75,000 paid to Stockton, Ulmer & Murchison, Jacksonville, Fla., for legal, corporate and CAB route proceedings (the firm got $72,600 in 1951).

Options to buy additional common stock before Dec. 21, 1955, at $5.50 per share, unexercised as of Dec. 31, 1952, were owned by Murchison, 2,900 shares (3,500); Lockhiel, 3,900 (5,100) shares; Wilson, 500 shares, Dever, 3,100 (3,200) shares; R. M. Averill, 500 shares, S. B. Goldthorpe, 700 (800) shares. Total outstanding Dec. 31, 1952, were 11,600 (13,600) shares of the 48,000 originally granted Apr. 20, 1949.

Other directors William V. Couchman, no shares, David L. Frawley, 1,020 shares; George R. Hann, 41,172 (40,272) shares common stock and $12,500 debentures; D. F. Gruenhagen, 100 shares, C. T. Johnson, Jr., 100 (none) shares; Arthur F. Kroeger, 200 (100) shares; Brouwer D. McIntyre, 200 shares; C. Bedell Monro, 900 (1,125) shares and $4,500 debentures, Thomas D. Neelands, Jr., 2,500 shares, Otto A. Seyferth, 200 (400) shares, J. R. Stockton, 550 shares.

Only owner of 5% or more interest in Capital common stock Dec. 31, 1952, was George R. Hann, Pittsburgh, 41,172 (40,272) shares, exactly 5% of the total outstanding.

Three Aviation Firms Report Top Salaries

Two major manufacturers and an aviation supply company have reported to the Securities & Exchange Commission annual salaries totaling $867,652 were paid to officers and directors last year.

The reports:

• **Fairchild Engine & Airplane Corp.** paid its president Richard S. Boutelle a salary of $105,870 during 1952. Arthur F. Flood, executive vice president and comptroller, received $76,292. Willard L. Landers, vice president, received $51,661. Fairchild paid all its directors and officers salaries which amounted to $419,268 during the year.

• **Grumman Aircraft Engineering Corp.** paid Leroy R. Grumman, chairman of the board of directors, $51,400 during 1952. Leon A. Swirbul president, received $61,650. William T. Schwendler, executive vice president, received $51,400, and E. Clinton Towl, vice president, was paid $33,000. Annual salaries of directors and officers totaled $239,050.

• **Aero Supply Manufacturing Co.,**

Corry, Pa., paid its president, S. J. Irvine, $27,983.20 in salary. All directors and officers of the firm received a total of $81,377.87.

Majority of Airlines Get Final Mail Rates

Nearly all of the 46 certificated airlines will be on a final mail rate by the end of this year, Civil Aeronautics Board officials predict. This means that for the first time in airline history, stockholders will be able to rely on reported profit and loss data and carrier managements will know where they stand on cash income and expenditures.

New airline mail rate orders recently issued by CAB brings the box score to 41 airline routes now on final mail rates and 17 still temporary. Separate current mail rates are boosted to 58 because Pan American World Airways has four separate divisions and nine trunk lines are operating overseas or international divisions.

New mail rate orders:

• **Reeve Aleutian Airways** final rate proposed in a CAB show-cause order raises estimated annual mail pay $73,000 to $303,407 from July 1, 1952, forward.

• **Northern Consolidated Airlines** final rate yields $1,152,000 for the 12 months ending last June 30 and $704,000 the preceding year.

• **Braniff Airways** temporary international increase of $1,642,000 wipes out last year's foreign route loss (AVIATION WEEK Apr. 6, p. 93).

• **Trans-Pacific Airlines** temporary rate increase proposed by CAB raises annual mail pay from $229,000 to $400,000.

• **Central Airlines** temporary increase of $216,271 brings the total for July 1, 1952-Jan. 30, 1953, to $1,053,772.

Box score of the CAB mail rates section on certificated airline routes—domestic trunk, local service, international and territorial:

• **Domestic trunk,** 12 to 2. Only Northeast Airlines and Braniff remain on temporary current mail rates, but both should get final rates before the end of this year. Four airlines still have open rates on past periods. Northwest Airlines, 1951 (settle this year), National Airlines, 1947-51 (in hearing now), Western Air Lines, Oct. 1, 1951-Apr. 9, 1952, (settle this year), Braniff, Oct. 1, 1951-Nov. 9, 1952 (hearing resumed last month).

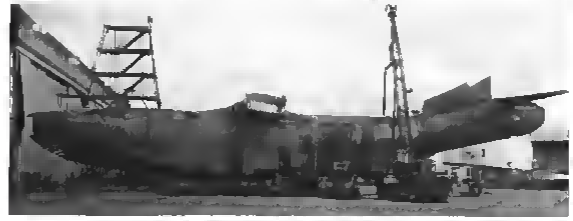
• **Locals,** 10 to 8. Including the three metropolitan helicopter services, there are 10 locals on final rates and eight temporary—of which several should be settled on final rates this year. Locals still on temporary rates: Central, Lake Central Airlines, Los Angeles Airways, New York Airways, North Central Airlines, Ozark Air Lines, Southwest Airways and West Coast Airlines.

• **International,** 10 to 4. There are 10 international routes on final rates, including the four "stub-end" routes of American Airlines, Eastern Air Lines, National and United Air Lines—which are now considered integral parts of the carriers' domestic systems and no longer are subsidized.

Four international routes currently on temporary rates: Atlantic Divisions of Trans World Airlines and Pan American, 1946 forward (hearings over, briefs to examiner now in preparation), Braniff Latin America Division, 1948 forward (settle this year), PAA Latin America Division, 1948 forward (settlement date unpredicted).

Three international routes have open rates on past periods: National, 1947-51 (at hearing), Northwest, 1951 (settle this year), United, 1946-August 1952 (prehearing conference).

• **Territorial,** 9 to 3. Hawaii and Alaska territorial operators have nine final mail rates and three temporary. Three remaining temporary rates: Alaska Airlines, Wien Alaska Airlines and TPA (Hawaii). Rate on Northern Consolidated is open from Nov. 30, 1947, to an as yet undetermined earlier period of origin of the various forerunner bush-type operators now consolidated into one carrier.



R3Y HULL MOVES OUTDOORS

Hull of a Convair R3Y-1 Tradewind turboprop flying boat is moved outside during transfer to another building. This particular hull will never fly, instead is slated to wind up at the seaplane ramp where it will undergo rigorous testing. Meanwhile Convair is busy at San Diego on an R3Y production program for Navy.

EAL Sees Traffic Doubled in Decade

It is very possible that in the next decade Eastern Air Lines will be flying more than 10 million passengers a year, compared with its expected 5 million during 1953, according to president "Eddie" Rickenbacker.

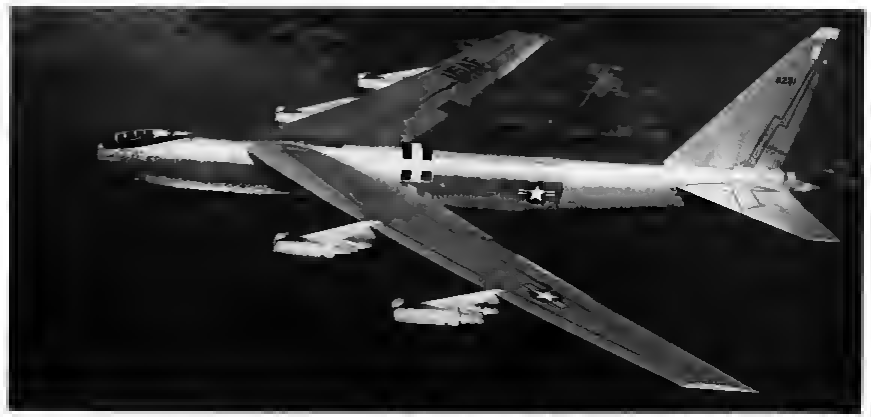
He also believes that the turboprop engine, which he hopes will be available soon for commercial use, will bridge EAL's jump from its piston engine Super Connies to the turbojet transport, which should be flying U. S. routes "by 1960."

While reviewing the carrier's past 25 years of operation, Rickenbacker looked ahead 10 years and said it is very possible Eastern will also:

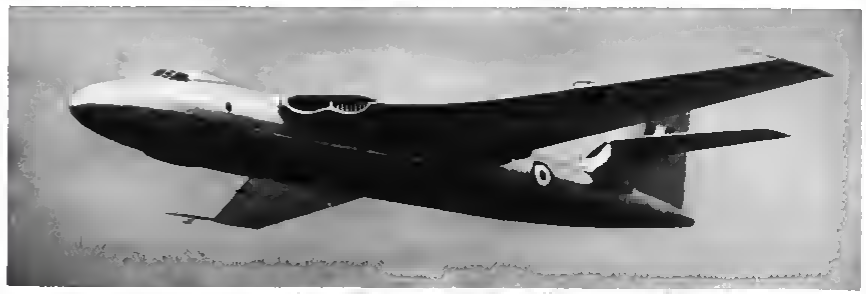
- Operate 80-100 passenger jet liners cruising at 550-600 mph. and flying nonstop New York-Miami and Chicago-Miami in less than two hours.
- Use giant helicopters for shorthaul intercity service.
- Operate a fleet of all-cargo planes with airfreight nearing passengers carried in volume and revenue.
- Land passengers and air cargo at separate airfields.
- Employ between 15,000-20,000 persons compared with present 9,500.

"CAPT. EDDIE" RELIVES PAST

Eastern Air Lines' president Eddie Rickenbacker flashes his famed World War I fighting grin as he poses in the cockpit of a Spad pursuit plane similar to the plane he flew to 26 victories. The plane is part of a "span of flight" air show the carrier is sending through most of the cities it serves in commemoration of EAL's 25th anniversary of operation, May, 1928-May 1, 1953. The carrier recently enacted its inauguration of mail service from Atlanta, Ga., to Hadley Field, N. J., by flying a Pitcairn Mailwing over the identical route. A Wright pusher of 1910 vintage makes up the airshow trio. These historical aircraft have been supplied to Eastern by speed pilot Paul Mantz.



POD INSTALLATION of jet engines, as typified in YB-52 (above), is standard U. S. design practice. Boeing's eight jet bomber carries two Pratt & Whitney Aircraft J57s in each of its four underslung twin pods.



BURIED INSTALLATION is the British approach to handling multi-jet powerplants. Vickers Valiant carries four Rolls-Royce Avons in its wings. Second prototype (above) has larger inlets than first model.

The Case for Pod-Mounted Jet Engines

- **Why do American designers hang their engines under the wing while British practice is to bury them?**
- **Here's what Boeing and Convair engineers say: It pays off in safety, performance, maintenance ease.**

By David A. Anderton

"Pod-mounted engines make a lot of sense," says George Schairer, Boeing's chief of technical staff.

"The buried turbojet powerplant cannot be justified," says Ben Salmon, Convair project engineer.

"We've argued back and forth," says a de Havilland spokesman, "and I reckon that we come out just about even on pods or buried installation."

These are some of the views in an international design controversy which has been aided and abetted by the successful operation of both types of basic installations.

▶ **Oceans Apart**—In the U. S. all multi-engined jet experience has been with podded powerplants. The Boeing B-47 and B-52 pioneered the configuration, and the same pods are on the Convair B-36 late models and the B-60.

In England, all multi-engined jet experience has been with buried engines. Starting with the de Havilland Comet, and going through the three Vees—Valiant, Vulcan and Victor—the engines have been buried in the wing.

Until recently, nothing official has been said on this side of the Atlantic to justify the strong alignment of U. S. designers behind the pod. But a few weeks ago at the national aeronautic

meeting of the Society of Automotive Engineers, Schairer and Salmon wound up and delivered their best pitches against the British team view that "buried is better."

► **Why Pods?**—Use of pods makes sense, says Schairer, because—other things being equal—we should expect more annual utilization and greater safety in airplanes provided with pod installations.

The buried powerplant can't be justified, says Salmon, because:

- **Cruising speed** is reduced because of increased drag due to wing thickness.
- **Wing weight** is increased because of cutouts in the structure, thus countering any reduction in gross weight because of lowered air loads.
- **Drag coefficient** is about constant for both types.
- **Engine losses** are increased because of lengthened inlet ducts and tailpipes.
- **Wing and powerplant installations** are more difficult and costly to build.
- **Powerplant access** is much poorer.
- **Apparent cleanness** has been improved by eliminating nacelles, but actually the drag increases.
- **Hazard due to engine fires** has been greatly increased.

There's an interesting sidelight behind the presentation of these two views at the SAE meeting. Originally the idea was to have speakers in behalf of each of the powerplant configurations. It turned out that no American manufacturer was willing to speak in favor of the buried engine and so there was no presentation of the positive values of such installations.

Schairer and Salmon take somewhat different approaches to the the subject. There are differences of opinion between them—Schairer sees little difference in cruising performance; Salmon sees 50 to 75 mph in favor of the pods, for instance. But they both come to the same conclusion.

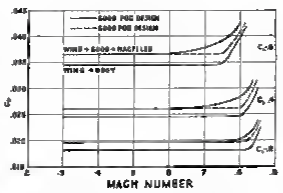
► **Schairer's Views**—Pod mounting is as old as multi-engined airplanes. In recent years the pods have been mounted ahead of the wings rather than below, but the jet engine changed that.

Based on the bad experience in World War II with engine nacelle fires, the twin problems of jet blast and fire led to the first thoughts of engines mounted in pods beneath the wings.

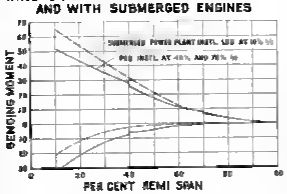
The next obvious advantage was the quality of engine maintenance provisions possible with the underslung pod. Performance considerations and other factors demanded more detailed investigation, so Boeing engineers dug deeper into the design details.

► **Performance Factors**—Schairer says that the performance of an airplane is to be measured in terms of the payload it can carry over various routes, and the speed and altitude paths possible. Overall performance is made up of the interactions of many variables into a complex whole.

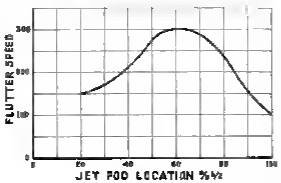
DRAG CHARACTERISTICS OF JET PODS



WING BENDING MOMENTS WITH PODS AND WITH SUBMERGED ENGINES



THE GENERAL RELATIONSHIP BETWEEN FLUTTER SPEED AND JET POD LOCATION



- **Engine performance**, for example, is influenced by intake and tailpipe changes. Long flow channels mean losses in thrust and increases in specific fuel consumption.
- **Aerodynamic drag** of the podded engine is tremendously important. Schairer credits about 18% of the total flat-plate drag of pod equipped airplanes to the pod installation. But he says a pod can be designed so that interference and compressibility effects are negligible or even favorable at moderate to high lift coefficients. A properly designed pod will have no interference drag and will give a negligible reduction in the critical Mach number of the airplane.
- **Span and aspect ratio** help determine range and altitude performance. The lift/drag ratio is proportional to the span divided by the square root of the flat plate drag; thus, says Schairer, a 9% increase in span will compensate for the 18% increase in flat-plate drag insofar as the L/D ratio is concerned.

In order to submerge an engine, you need a large wing chord and thickness at the engine location. If you try to do this with a basic wing geometry by increasing the chord at the root, then span and aspect ratio (for the same area) decrease.

If you increase the chord at the engine locations only, it may not increase the available lift on the wing, particularly in the case of the sweptback surface where stall starts near the tip. It is also fair, in this case, to charge the engine installation with all the drag caused by the local wing area increases.

Changing wing dimensions or layout may also mean significant changes in tail area, where increases will boost both the drag and the empty weight of the airplane. But balancing this is the increased volume available in the wing (from reducing the aspect ratio) which could be beneficial in drag and weight in relocating such items as the landing gear.

What it all boils down to, Schairer indicates, is that adding all these aerodynamic characteristics together gives no obvious conclusions. Comparing performance for comparable airplanes designed with the two engine schemes is necessary.

All such studies known to Schairer have shown the lift drag ratio of high aspect ratio airplanes with pods to be clearly superior, without considering the improved engine performance available.

► **Structural Benefit**—The relieving moments from mounting the pod engines out along the span help to reduce bending on the wing. Negative bending moments will increase, but seldom to the extent where additional structure would be necessary over and above that needed to meet positive bending moment requirements.

This comparison is not strictly valid in some cases, says Schairer, because it it normal to reduce the aspect ratio for submerged installations, this decreases the bending moment and increases the structural depth. This makes it difficult to estimate the effect of engine installation on the primary structural weight. When you mount the engines inside, there are also secondary effects on wing weight because of access doors, cutouts for intake and exhaust air and other small doors. This means a large amount of built-in empty weight.

In the engine installation, weight provisions must be balanced for fair comparison. The submerged engine requires a long intake duct, a long tailpipe with heavy shrouding and a reasonably fireproof compartment, which all involve a lot of weight. This extra poundage must be compared to the weight of cowling and support structure for pods, plus the modest amount of fire protection between engine and airframe structure.

Schairer concludes that there is no

simple answer to determine relative weights of the different engine installations. Neither is there a simple single solution to the over-all performance summary.

All comparisons available, says Schairer, have shown negligible differences in performance capabilities for different types of installations. The final choice must be on factors other than performance.

▶ **Safety Consideration**—With the pod, there is little chance of a fire in the engine nacelle doing damage to the primary structure. The strut mounting can provide free air between the engine and the wing, except for the closed portion of the strut itself, which can be partitioned to hinder the progress of a fire from nacelle to wing.

For long-range airplanes, providing fuel storage space is difficult. That space will inevitably approach the sides of the fuselage. Submerged engines could be expected to use so much of the desirable wing space that fuel will be required in the body. Furthermore, this fuel is usually separated from the engine compartment inboard and outboard by a thin unventilated firewall of very large dimensions. Installation of pods bypasses this problem.

Since a large percentage of flight safety incidents involve powerplant malfunctions, the excellent engine maintenance and inspection possible with pods is a major safety factor, says Schairer.

Isolation is desirable for a number of reasons. Jet blast interference with structural integrity can be minimized, engine failure is completely separated from other engines, fuel system and control system can be kept away from the engines, and emission of fuels, oil or vapors can be away from the airplane.

▶ **Easy Maintenance**—All of the cowling comes off the B-47 pod engines, leaving a bare engine supported at two points with complete access. Most items can be reached by opening one powerplant cowl panel.

Schairer says that it would seem logical to credit in the annual utilization possible with a airplane some fraction of the time which can be saved in servicing the powerplant. If the engine is hard to reach, the annual utilization will go down, access to the engine should be good enough to permit thorough pre-flight inspection without significant delays.

There are a number of other factors weighing in favor of the pod. Schairer says that pod mounted engines can do these things:

- **Delay onset of flutter materially,** but chordwise position of the nacelle center of gravity must be ahead of the wing leading edge. Also the bending stiffness of the structure between wing and nacelle must be controlled to avoid unfavorable tuning between wing and nacelle frequencies.
- **Produce the aerodynamic functions** of fences and slats on longitudinal and lateral stability and control near the stall.
- **Reduce noise level** for the passenger as compared to engines mounted in close to the body.
- **Give some control of airplane CG.**
- **Result in a cheaper airplane.**

▶ **Other Questions**—Schairer said that numbers of questions have come up on the pod installations which are not directly pertinent to the design considerations above.

Typical is that of airplane and engine height. Schairer points out that most sweptback airplanes are critical at the wingtip and flap tip for ground clearance, and that it is generally possible to arrange the engine below a minimum height wing and still get adequate ground clearance.

On pickup of objects into the air inlet, Boeing experience has shown that the engine would pick up a candy wrapper from a flat board only when the board was within 18 in. of the engine.

There are no important relationships between pod installations and aileron reversal yet identified; aileron reversal

must be treated in the conventional manner.

Schairer says that experience with pods getting knocked off has been satisfactory, the engine may tear itself loose without serious damage to the airplane, and damage to the pod will not carry through into the basic structure if the pod is properly mounted.

Contrary to another argument, there is room for proper mounting of engine accessories. It has always been possible, says Schairer, to mount the accessories so that a minimum drag cowling can be placed around the engine.

On engine-out performance, Schairer states that the problem is much less severe than with propeller-driven aircraft. No rolling occurs when the engine fails until the airplane has begun to yaw, this compares with an immediate large rolling moment when the propeller loses thrust. The unsymmetrical thrust is not important in cruise, says Schairer, but is in climb-out performance and must be considered by designers.

▶ **Salmon Says**—Convair's Ben Salmon defines the type of jet transport airplane he is talking about: it is to have cruising speeds from 450 to 600 mph. at operating costs equal to or less than today's first-class transports.

Such an airplane powered by turbojets would be the first opportunity to give the passenger a virtually noiseless and vibrationless ride. "The powerplant configuration chosen by the designer will determine whether this extremely desirable feature is realized or sabotaged," Salmon claims.

To do this, all passenger accommodation must be located ahead of a cone with 120-deg. vertex angle at the center of the jet nozzle. With the exhaust position fixed, the next thing is the physical location of the engine. This in turn means consideration of the inlet ducting and tailpipe.

The engine is interested only in what it senses at its inlet. The pressure there is the sum of the static head and the velocity head (or ambient pressure and ram, if you prefer). At high altitude, the velocity head can account for 50% or more of the total head, thus any loss here is serious.

▶ **Losses and Size**—Salmon makes an interesting point in relating the duct inlet losses to the airplane size.

"It can be categorically stated that the entire class of airplanes represented by the jet transport are what might be called fringe airplanes. This simply means that if no determination of specified performance is permitted, small variations in drag, specific fuel consumption, or weight of component items have a much larger effect on gross weight, size and operating cost," Salmon says. Example: A 15% increase in drag or specific fuel consumption will

mean a 50% increase in airplane size.

Other things being equal, the major design objectives are the best possible total head recovery and the lowest possible inlet duct losses.

The tailpipe is different, according to Salmon. Losses due to length are not of the same order of magnitude as for inlets unless the tailpipe is very long or changes direction. In general, the cost is one-third percent thrust loss per foot of tailpipe length.

▶**Location and Tail**—Sweptwing high-speed airplanes require the horizontal tail to be located as low as possible with respect to the wing zero-lift line. This tends to put them in the jet blast, which is highly directional and modifies—or obliterates—local wing downwash. At a typical distance between horizontal tail and the jet exhaust, the blast will be at a speed of about 300 feet per second and a temperature of 200F or more.

The effect of velocity and temperature on the direction of the relative airstream at the tail can be quite serious because of the deterioration of stability.

Therefore the designer either has to locate the engines far enough out along the span to clear the tail, or low enough or tilted down enough to clear the tail by a safe margin.

▶**Wing Thickness**—Salmon says that the typical transport would require a wing thickness of 7 to 11%, in actual depths, this would be around 18 inches at the powerplant spanwise location, and about 30 inches at the airplane centerline.

Main landing gear for such an airplane would be a four-wheel bogie type with 50-in. tires. To house the retracted assembly would take a space about five feet by ten feet. "Such a gear can neither be stowed in the wing at the nacelle location or just outboard of the wing root, even if retracted inwardly," Salmon says.

Engines would be about 48 inches in diameter by 10 feet long, another package which is too big to justify cutting into the wing structure.

A 525 mph airplane requires an 11% average thickness wing, at 600 mph., the wing has to decrease in thickness to 6%. So even though wing chord is increased as thickness is reduced—because of decreasing aspect ratio—the available wing depth is still reduced to less than the dimensions needed to bury the engines.

The delta, Salmon claims, is the one sort of configuration fast enough to justify turbojets and thick enough to bury them. Such an airplane might use wholly submerged turbojets without a sacrifice in speed or thickness.

▶**Drag Comparisons**—A typical drag breakdown given by Salmon credits the fuselage with almost one-fourth of the

total drag, and the nacelles—for four turbojets and landing gear—with about seven percent. The only gain from burying engines must come out of the seven percent, and some of that must be charged to duct losses. So, Salmon says, about five percent reduction of total airplane drag is the best improvement to expect from buried engines.

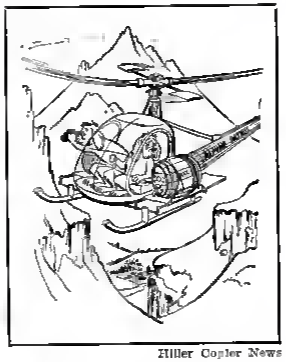
Turning to fuel storage, Salmon said a nonstop trip of about 3,500 mi., hauling from 80 to 100 passengers on a seven hour schedule, would take about 80,000 or 90,000 lb. of fuel.

All of this capacity can be housed within the wing in integral fuel tanks outboard of the fuselage half-breadth and between shear beams at 15% and 60% of the wing chord, provided the wing structure is unbroken from root to tip. The storage problem "alone is sufficient to justify an unbroken structure," Salmon believes.

Thus the several design considerations combine to recommend an unbroken wing structure containing all of the fuel outboard of the fuselage, and with suspended powerplant nacelles also housing the landing gear.

▶ **Other Possibilities**—Salmon points out that only one basic airplane concept was considered in his paper: a highspeed, thin sweptwing airplane, either high or low wing. But other configurations are available, he says. It could be entirely possible that the case for riding comfort with a moderate speed increase over today's transports could give enough customer appeal—coupled with operating costs comparable to a DC-6B or Constellation—to tip the scale in favor of a lower speed jet transport.

But re-examination of these other configurations still does not sell Salmon on the idea of the buried engines. Considering the same basic arguments that Schairer does—maintenance, wing structural weight, fuel storage and fire—he comes to his conclusion: the buried turbojet powerplant cannot be justified.



Hiller Copter News

THRUST & DRAG

"I'm annoyed at this deal of buying MiGs and pilots from the Chinese," said the engineer. "It just gripes the hell out of me from a couple of angles."

"Howso?" I asked, signaling the waiter for another round.

"Well, for one thing, suppose we get a MiG. Who's going to get to see it? I worked near the top of a design staff during the war when we were getting flyable Zeros by the gross, and I never saw one. Neither did my boss. We did get to see the reports some months after the war was in the bag.

"For another thing, if we do get a MiG, why should we care how the Russians built their airplanes last year? We need to know what's up their sleeve. We can beat the MiGs ten-to-one right now, and knowing how they fasten the wing to the fuselage isn't going to increase that ratio. Isn't combat supposedly the ultimate proof of a fighter design?"

"That's what the Air Force says," I told him. "Two more, please."

"But here's what hurts," the engineer said. "Some poor guy on the drawing board at North American comes up with a smart idea to fix the Sabre. Then try it, and what happens? The Sabres in Korea now are outflying—as well as outkilling—the MiGs. Did that guy get $50,000? Did he even get a letter of commendation from the Air Force? Nope. He's probably back designing access doors, even though his personal contribution to the war has saved more U. S. pilots than a few delivered MiGs will save."

He looked glum, and stared at the bottom of the glass for a moment. "There's one last item," he said. "We've been preaching the beauties of the American way for years, and no Reds have deserted, complete with airplanes. This sort of says that a fine upstanding intangible appeal is no good, and we've got to wave those long green bills around instead. Money seems to outweigh ideals, doesn't it?

"And you know what I'd like to see? That MiG pilot's face when he is met at the plane by some character from the Bureau of Internal Revenue, and finds out that $50,000 is taxable income."

* * *

Maximum Lift Award of the week goes to the American Meteorological Society for the slogan in its current program for the 122nd National meeting: The Society with an Atmosphere.

—DAA

EFFECTIVE THROTTLING of noise is claimed for Avro test building where . . .

ORENDA JETS are checked. Adjacent control room is acoustically isolated

Avro Kills Orenda Jet Test Noise

Throttling of engine test cell noise has been one of the major achievements in the overall design of A. V. Roe Canada, Ltd.'s, new manufacturing facility for the Orenda jet at Malton, Ontario.

The noise suppression plan is a comparatively simple, effective scheme designed by the engineering firm of Giffels & Vallet of Canada, Ltd. Report is that the occupants of Avro's employe cafeteria, which is located no more than 100 ft. from the test area, are not disturbed even when all six cells are operating.

► **Cooling First**—The test cells have vertical intake and exhaust stacks at each end of the chamber proper. Both stacks are filled with sound-absorbing panels and the intake unit is screened to keep out foreign matter.

Cases leaving the engine exhaust (without afterburner) are at a temperature of about 1,300F. Cooling is effected (before contact is permitted with the sound absorbing material) by placing a bell-mouthed augmentor or mixing tube a short distance behind the jet tailpipe. The high-velocity stream draws several times its own volume of cool air into the tube with it, reducing the gas temperature to about 430F.

Provision also is made for spraying the gases with water if this is found necessary with other engines that may be developed.

► **Grill Dissipator**—To combat the tearing, buckling and breaking effect of hot, high-speed gases as they leave the augmentor tube and the first sound muffler, an iron grill and steel-lined chamber was provided at the base of the exhaust stack. This breaks up the gas stream and dissipates some of its energy.

After passing through the grill, the gases strike a cellular sound trap designed to break up the low-frequency sound waves—a big part of jet engine noise.

► **Venturi Effect**—From this point the gases are directed up through a baffled stack. The exhaust end is topped by two converging plates with undersides lined with sound-absorbing material for further noise reduction. The plates restrict the stack opening to produce a high-velocity effect and impart an upward direction to the residual sound.

The control room is isolated from the test cell structure by independent walls, floor and roof. Acoustic treatment in the control room is said to permit conversation in normal tones while the engine is running at full throttle in the adjacent cell.

Bristol Offers Bigger Faster Britannias

A new trio of Britannia turboprop airliners—one each for freight, passenger and mixed service—will be available for delivery in 1956 and 1957, says the Bristol Aeroplane Co., Ltd., Bristol, England. The designations and types:

- **Mk. 200** is a freight transport.
- **Mk. 250** is for mixed freight and passenger service.
- **Mk. 300** is a passenger job.

Developed as "stretched-out" modifications of the standard Britannia Mk. 100, the three will have an increased gross weight of 155,000 lb. as compared to the 140,000 lb. of the current type. Proteus 750 turboprop engines will power the new versions, the 750 is rated at 4,150 ehp. while the current 705 engine in the Mk. 100 is rated at 3,780 ehp.

The larger accommodation of the new series results from the addition of 10 ft. 3 in. to the fuselage length.

Capacity payload will be increased from the 25,000 lb. level of the current Britannia to 30,000 lb. This represents an increase in percentage payload (as a portion of the gross weight) from 18% in the Mk. 100 to 19½% in the three upcoming Britannias.

Increased power and improved economy of the Proteus 750 engine will make it possible to carry the larger payload at a higher cruising speed and over a longer range with the same fuel capacity as in the standard Britannia. Bristol says that the range with capacity payload will be 3,940 statute miles at a maximum cruise speed of 389 mph.

Help for American Users of German Tools

Tool builder Schiess A. G., Duesseldorf, Germany, is establishing an affiliate, American Schiess Corp., at 205 E. 42nd St., New York, to provide technical assistance for American and Canadian industrial plants which use the company's equipment.

Engineering headquarters and servicing facilities of American Schiess will be located in Pittsburgh, Pa., where the company will stock replacement parts and demonstrate tools. Engineers and mechanics from Germany will be available there to provide installation, training and maintenance service on standard company machines, and will offer consultation service on design and construction of large special-purpose units.

Designing for Reliability

FACTOR	WHAT TO DO ABOUT IT
Complexity	• Save weight by simplification. • Design to range of requirements. • Reduce number of components. • Simplify system arrangement • Eliminate marginal systems. • Replace sequence functions with mechanical linkages. • Perform failure analysis
Interconnected Systems	• Simplify to save weight rather than interconnect • Examine systems for interconnection in pressure lines, return lines, reservoir pressure lines. • Emergency components must not be part of normal system • Eliminate interconnection components.
Peak Pressures	• Design to prevent peak pressures • Check inlet, outlet on pressure regulators, solenoid valves, sequence valves, flow regulators, other control devices • Check effect of Gs on actuated services. • Check all pressure and return lines • Conduct final peak pressure check with instruments
Back Pressure Effects	• Eliminate designs affected by back pressure • Check each subsystem in every control position for back pressure effect when operating other subsystems. • Check effect of Gs on actuated service on own subsystem and other subsystems. • Check residual back pressure for effect on emergency operation
Reduced Flow Effect	• Eliminate designs affected by reduced flow • Check system functioning for all obtainable flow rates • Check devices dependent on flow rate for flow range • Check single-pump performance on multi-pump systems • Check shifting devices with reduced flow, considering leakage.

FACTOR	WHAT TO DO ABOUT IT
Increased Flow Effects	• Keep flow-increasing devices to a minimum • Check effect on detail design of components. • Check peak and back pressure effects • Check effect on subsystem functioning. • Check exhaust direct to reservoir • Check effect where G and air loads drive actuated service, especially large vo ume cylinders.
Accelerations	• Consider G capabilities of aircraft in design • Check effect of Gs on each component, internal mechanism, fluid column, fluid mass, on components (without pressure) for emergency use, and on other significant masses
Depressurization	• Check systems for depressurization, especially sequenced subsystems. • Consider G or air load on actuated service • On intentionally depressurized systems, eliminate marginal electro-mechanical sequencing
Air Inclusion	• Design for automatic bleeding to prevent air inclusion • Check all components for air inclusion • Consider effect of G and air loads • Check air inclusion on dead systems. • Check multi-pump systems for air bleed. • Check air inclusion on filling
Temperature	• Design for calculated temperature • Check ambient temperatures, component inefficiencies, other heat sources, component design for actually encountered temperature, low-temperature performance • Instrument and obtain actual system and component temperatures. • Cool if necessary

Making the Hydraulic System Reliable

Advanced planning of functions, minimum of gadgets and complexity are called key to dependable operation.

The hydraulic system for one of today's planes is a complicated maze of line and gadgetry. Yet it must play a vital role in the safety and performance of the aircraft.

This puts a heavy accent on hydraulic system reliability. Industry engineers at the recent National Aeronautic meeting of the Society of Automotive Engineers, in New York, heard Leo Morse Chattler, who heads the Navy Bureau of Aeronautics' flight control system section, outline the causes of malfunctions and suggested corrections.*

▶**Large Order**—Chattler puts it this way: "We are no longer dealing with a simple hydraulic system for the operation of landing gear and flaps.

"We now have to design hydraulic systems for wing folding, wing flaps, variable-sweep wings, bomb-bay doors, canopy and escape hatches, cowl flaps, arresting hooks, hoists, constant speed drives, power-boosted and power-operated flight controls, automatic pilots, operations of electronic devices, speed control devices, armament controls and devices, damper devices and many other services.

"These systems include many high-response servomechanisms which must function in an atmosphere from sea level to 50,000 ft. at a temperature range of —65F to +200F, must withstand loadings up to 40G, must withstand high and low frequencies with small and large amplitudes and the stresses and strains of being attached to an elastic airframe.

"To design for these conditions and for these important functions brings new meaning to the reliability of an aircraft hydraulic system . . . We have to become reliability conscious."

▶**Reliability Factors**—It is unrealistic, Chattler says, to expect that an aircraft hydraulic system will never have any failures. We have emergency systems because we expect failures.

But a hydraulic system, with its complementary emergency system, is unreliable if failures occur which result in aircraft accidents. A system is unreliable if, although safety in flight and landing are not involved, system components or the installation fail frequently enough to cause a decrease in availability of the aircraft.

Other conditions tending to reduce reliability of aircraft hydraulic systems include:

- **High** degree of complexity, tending to make preflight or periodic inspection periods so cumbersome for maintenance personnel that it is difficult to determine whether the system is working properly.
- **Poor** accessibility, which prevents

*Title of Chattler's paper: "Design for Increased Reliability of Aircraft Hydraulic Systems." The opinions expressed are his own and do not necessarily reflect those of the Navy.

maintenance personnel from observing equipment and tubing to see if small leaks have developed.

• **Poor installation and marginal** strength designs which, after the first service tour, cause pending fatigue failures of materials due to system impulses and vibration.

▶ **Complexity**—It has been Chattler's experience that "complexity" is one of the most important factors affecting aircraft hydraulic system reliability.

He realizes that a modern high-speed, high-altitude, high performance inhabited plane cannot be designed to be an accurate gun or bombing platform without some gadget and some complexity. But he does contend that a great effort should be made to keep both gadgets and complexity to an absolute minimum. He decries complexity resulting from poor design or "patchwork."

Here's how Chattler sees complication creeping in:

When a design engineer finalizes a hydraulic system to perform many complex functions, he usually ends up with a complicated system, and because of the time involved, he generally does not attempt to redesign to simplify the system. It's easy to see how this happens, Chattler says, when one considers that the aircraft hydraulic designer starts his design with only vaguely calculated requirements which become more realistic as the aircraft design progresses, with the resulting patchwork. Because patchwork consumes less time, it usually results instead of a complete redesign of the system or subsystem.

Another factor tending to complicate the system is the inclusion of additional subsystems after the basic design has been completed.

Or, late in the system design stage, the hydraulic designer, his group leader, or the procuring agency, discovers discrepancies or non-compliance with specifications, leading to additional patchwork, which further complicates the system.

Then, during early production stages of the aircraft, additional discrepancies are discovered, and again complication results.

Beyond this, after the aircraft is in service, additional troubles usually develop and still more complication is added.

▶ **Planning**—Chattler believes that the aircraft designer can overcome a great many of these difficulties by a certain degree of advanced planning, such as:

• **Designing to a range of requirements** rather than specific estimated requirements, especially when questionable data, which can only be obtained by flight tests, is available.

• **Obtaining a review of the system by** the most competent personnel in the plant, in addition to the procuring agency, at a very early stage in the design, even though the designer does not consider the system to be finalized.

• **Reviewing the system from a "why it** won't work" viewpoint rather than "why it will work" viewpoint—in other words, performing a failure analysis on the system.

• **Eliminating marginal situations**, that is, if the system appears to be marginal in certain aspects, redesign rather than wait to find out if it will work.

• **Redesigning** when a new requirement arises requiring the inclusion of an additional subsystem which, if installed, may jeopardize the basic system.

Chattler stresses that a good job must be done early in the design stage so that production-line changes and especially service changes can be cut to an absolute minimum. Much effort is involved in affecting a change on the production line. It is even more difficult to effect a change in the system after it is in service.

▶ **Simple Systems**—The hydraulic designer must remember that the system he designs must be manufactured, inspected and tested by production personnel and thereafter maintained by service personnel. This means that the system should be of such design that these jobs can be accomplished satisfactorily.

factorily in minimum time by the talent available.

Chattler does not contend that personnel could not be trained to deal with complex systems. But the time factor is against them, he says. Squadron personnel generally do not stay in one place long enough to comprehend thoroughly a complex system.

Chattler points out the difficulty in trying to check a system for proper working order, such as is necessary in preventive maintenance or trouble-shooting, if the system functions are not clear. He contends that even hydraulic designers get into difficulty with complex systems, because the analysis of these systems is so difficult.

▶ **Case of Complication**—Chattler gave as an example of an unnecessarily complicated system a brake system designed for a carrier based aircraft.

Master cylinders operated power brake valves, which in turn fed system pressure to the wheel brake. The emergency system used the same master cylinders but, by the use of a selector valve, permitted shifting of master cylinder fluid through a separate set of emergency brake valves feeding pressure from a separate emergency system through shuttle valves to the wheel brake. In addition, a parking brake valve, receiving its pressure from the same emergency system, supplied pressure to the wheel brake for parking.

This brake system was considered reliable because three means were provided for applying brakes. Actually, brake system failures did occur—both manual and emergency systems failed to function. In every case, maintenance personnel had great difficulty in determining the reason for the failure.

One of the biggest faults of the basic complicated system was that no true emergency system actually existed.

The master cylinders were common to both the normal and emergency systems. Hence, any type of failure in the master cylinder circuit resulted in failure in both the normal and emergency systems.

In several instances, the rudder pedal mechanism held the pedal in the depressed position, so that when the normal system failed and the selector was shifted to emergency, the master cylinder was unable to replenish its supply of fluid to permit operation of the emergency valve.

Simplification of the system overcame the trouble.

▶ **Interconnected Systems**—Many designers have interconnected various separate systems to accomplish weight savings and other benefits. This is a serious reliability factor, Chattler says. Unless the designer is exceptionally careful, a single failure can cause multiple system failure.

In one undesirably interconnected

system, three supposedly independent systems failed as a result of a maladjustment on the part of the wing flap emergency selector valve handle and a failure in the normal utility system.

Here's what happened: A leak developed in a fitting in the utility system's main pressure line, and the wing flap emergency selector valve had a position which would supply emergency pressure to the utility system. This valve and lock were improperly adjusted so that emergency fluid was leaking into the utility system.

There was no leakage so long as utility pressure was opposing it. But when the utility system lost all of its fluid, as it did, the emergency system fluid also was lost through the same leak in the utility system. Because the emergency fluid supply was the bottom half of the aileron boost reservoir, it also drained all of the aileron boost fluid. In this way, all three systems failed.

To prevent recurrences of these conditions, a separate emergency system reservoir was provided and the emergency to normal system interconnect was eliminated.

This same system had another undesirable interconnect—the common reservoir pressurization line. If this line failed or one of the reservoirs failed, pressurization would be lost to all systems.

▶ **Peak Pressures**—Development of peak pressures higher than the allowable 135% of system pressure must be considered in designing for system reliability, Chattler contends, especially insofar as seal life and structural damage from fatigue are concerned.

The most common causes of pressure surges or oscillation are those accompanying the rapid opening or closing of valves and the pressure fluctuations existing during normal pump operation or with pump cavitation. The former are transient pressure surges or damped pressure oscillations, while the latter are a steady state condition tuned to the pump piston frequency.

Chattler says more time must be spent determining these pressures analytically and then checking by actually instrumenting the aircraft.

Chattler spoke about high rates of flow being suddenly stopped or shifted into other static fluid columns. Particular attention must be paid to inlet and outlet flows in pressure regulators, solenoid operated control valves, manually operated control valves where high mechanical advantage levers are used, flow regulators, sequence valves, pressure-operated shutoff valves, and other devices which may suddenly stop or start fluid flow.

Not only the pressure lines, but return lines also must be considered. Chattler says many designers are under the impression that return line pres-

HIGHLIGHTS IN *Jet Engineering*

New jet engine designs further reduce frontal area

With their introduction of the first axial-flow jet engine over ten years ago, Westinghouse engineers expanded their efforts to reduce aerodynamic drag to an absolute minimum. Continued designing and testing met with outstanding success on the J34 engine, first in its class with the smallest frontal area per pound of thrust . . . permitting the first twin-jet aircraft design. The unequaled performance of twin-jet planes in Korea has put real meaning in that record.

While the J34 was writing jet history in combat, Westinghouse had new pencil-slim engines in their test cells . . . new designs for a more powerful jet engine that promised even greater latitude in plane design. Today, those designs have made possible the J40 with the smallest thrust frontal area ratio of any announced engine.

Realizing that even projecting rivet heads can have effect on the speed of jet aircraft, Westinghouse engineers know that they must respect every aerodynamic factor. That is why they have maintained leadership in the development of axial flow engines . . . why they have designed jet engines smaller in diameter for given power output than any other manufacturer. That is why they have acquired a wealth of jet engineering and designing knowledge that will prove invaluable to commercial airlines tomorrow. Westinghouse Electric Corporation, Aviation Gas Turbine Division, Philadelphia 13, Pennsylvania

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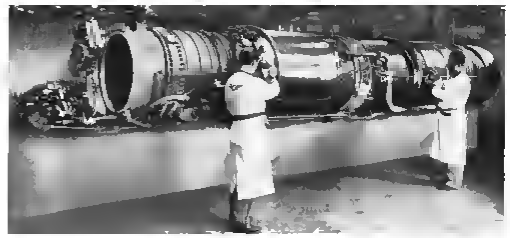


Final Assembly. Shown above in the last stages of assembly is the Westinghouse J40 . . . world's most powerful jet engine, fully qualified for production

YOU CAN BE **SURE**...IF IT'S

Westinghouse

sures are low. In a recent series of tests on several different model aircraft, return line peak pressures as high as 3,400 psi were recorded.

▶**Intermediate Stops**—Particular attention should be paid to subsystems where the actuation is stopped in intermediate position.

Generally, when the actuation involves only complete half cycles, the snubbing effect of the output elements gradually stops the fluid flow in the system.

But where intermediate positions are involved, the control valve action stops the fluid flow, such as in wing-flap systems, dive-brake installations, in power-boosted and power-operated flight-control systems, and especially in wingfold installations where the inertia loads of the wings are involved.

Another condition that develops high-transient pressures is the effect of Gs or other types of forces acting on the actuated element of the system.

For example, in the landing gear system one must consider the effect of G, the effect of applying wheel brake during the retraction cycle, especially on landing gears that are actuated fore or aft, the gyroscopic effect of spinning wheels, especially if the gear rotates through the gyro plane during retraction, and the effects of ground checking the landing gear without the damping action of air loads.

▶**Back Pressures**—Chattler contends that insufficient consideration is being given to the inter subsystem back-pressure effects in hydraulic system installations.

The general practice in system design is to have a common pressure and return line. When this is the case, it is important that the back pressure at each subsystem control valve be determined when every other sub-system is in operation, and the effects of these pressures determined for each position of each control valve.

It is important, he says, to consider the back pressures that may exist in certain types of system failures to insure that the emergency system will operate properly.

One of the most common faults, Chattler says, has been the case where the landing gear contains single-acting cylinders operating down-lock mechanisms in the gear-down position. The back pressure effect of retracting wing flaps, where the air loads act to move the flaps or when the wings are folded and fall from top-center position, tend to unlock the down lock and cause the landing gear to collapse.

Also, in the case where over-center linkages are used, as for landing gear down lock, the back pressure moves the gear cylinder sufficiently to unlock the over-center linkage and the landing gear again collapses.

When designing automatic mechanical advantage changers for power-boost systems with mechanical disconnects on the boost cylinder, it is important to remember, says Chattler, that a mechanical disconnect which might be necessary for reasons other than hydraulic system failure would result in loss of boost without an increase in mechanical advantage.

The system should be so designed, he says, that when the mechanical disconnect is actuated, the system pressure is simultaneously bypassed.

▶**Reduced Flow**—Another oversight on the part of the designer, bearing on aircraft system reliability, is the effect of reduced flow on pressure devices

QUICK DIP AND DRY

Five minutes is all the production time required on this conveyer dipping and drying line at Pastushio Aviation Corp., Los Angeles, for corrosion-protective treatment of jettisonable fuel tank components. Parts are cleaned, rinsed, coated with Alodine 600, rinsed again, acidulated rinsed, then dried by convection currents.

which are dependent on flow to create proper pressures, such as restrictor units installed for creating upstream pressures.

This reduced flow occurs when engine-driven hydraulic pumps are used—that is, in the approach condition of the aircraft where the engines are at reduced rpm., and taxi conditions where the engines are also at relatively low rpm.

In multi-pump installations, consideration should be given to single-pump flow performance and its effect on the system at reduced engine speeds, Chattler says. Pumps which have very low volumetric efficiencies at low rpm. should also be examined.

▶**Accelerations, Depressurization**—In dealing with aircraft which during normal maneuvers can create as high as 7G, serious consideration must be given to the effects of these accelerations on the functioning of the hydraulic system, the components, the mechanisms within the components, the fluid columns, and other large fluid masses.

Whenever a subsystem of an entire system is depressurized, consideration must be given to the effects on the positions of the actuated services, Chattler points out.

In most cases mechanical latches must be used to retain the services in the position to which they were actuated. Hence, one of the important considerations with a depressurized subsystem is to insure that marginal adjustments in the locked position do not exist.

In sequencing operations it is important, Chattler says, that the depressurization caused by sequencing one circuit to another be checked.

In one case, the landing gear doors were sequenced to the main gear in such a manner that when the doors were open a sequence valve was actuated to permit the main gear to unlock and extend. As soon as the gear started to extend, the gravity effect would cause it to exceed the pump rate and the pressure in the main gear door cylinder dropped to zero. Then, the air loads acting on the gear door would drive the door into the gear before it was fully extended.

▶**Air Effects**—Many systems have been designed recently where insufficient consideration has been given to bleeding air from the system and to prevent air from entering the system, Chattler reports. This, he says, is a serious reliability item.

In several recent cases designers have installed U-cup type seals in lieu of O-rings in flight control system actuating cylinders to reduce friction. This he considers poor design, because in a flight-control system, the surfaces in returning to the feathered position can be driven to this position by a gust air load that usually exceeds the fluid supply.

When this occurred, air would be sucked into a cylinder and system instability could result.

Chattler says that in multi-pump installations it is important to install air-bleed provision in each pump pressure line to permit the pumps to prime properly after a system has been overhauled, repaired, or a new pump installed. The reason is that one pump will usually prime itself first and build up system pressure against the opposite pump's check valve, thus preventing the opposite pump from priming. In these installations, it is also important to insure that adequate capacity air-bleed devices are used.

▶**Temperature**—High temperatures in hydraulic systems are rapidly becoming a very serious problem. This difficulty can be alleviated substantially if temperature is considered during the design of the system rather than first designing a system, be the temperatures what they may, and then trying to do something about it, the BuAer control systems chief contends.

Speeds increase the temperature problem, but Chattler says there are a large number of lowspeed planes that have hydraulic system high-temperature problems.

Designing now to keep system temperatures down is a real necessity, he claims, in order to permit high temperature developments to catch up.

Chattler mentions the items that affect the system temperature and points out what can be done to solve the heat problems.

• **Ambient temperature of the system.** Avoid hot spots, if unavoidable insulate or provide cooling or ventilation for the compartment, install lines to take advantage of cooling by radiation, and avoid other heat producing equipment.

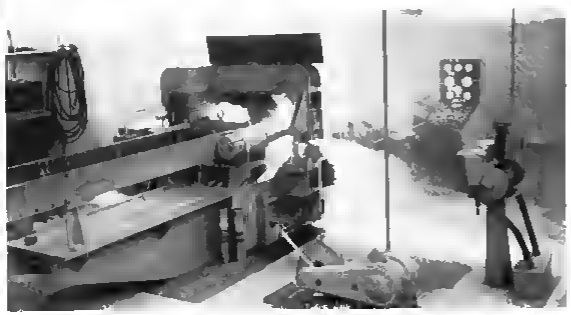
• **Volumetric and mechanical efficiencies.** Calculate efficiencies and then design for high efficiencies, avoid waste in power by use of flow regulators or restrictors with high pressure differentials, design subsystems to take advantage of the system pressure, reduce internal system leakage.

• **System design.** Avoid circulating systems where heat is generated when no work is done, insure that cooling bypass lines, such as on variable displacement pumps, have a minimum pressure drop, where high power drives are used for intermittent loads, make provisions not to waste power during low-load conditions, avoid using relief valves for pressure regulating devices even for small periods of time, examine complete system for heat-producing devices and design to reduce the temperature.

▶**Low Temperatures**—Low temperature also is a serious problem.

Chattler contends that many designers attempt to eliminate excessive operating pressure by reducing the line size to create higher pressure drops, without consideration to the fact that the pressure drop will increase rapidly with a decrease in temperature. Installation of a flat plate orifice restrictor, on the other hand, would make the pressure drop relatively independent of temperature.

—Irving Stone



HUGE FLASHWELDER MAKES SPARKS FLY

Hoge Taylor Winfield flashwelder is being tested at Douglas Aircraft Co.'s Long Beach, Calif., plant to eliminate hand welding of C-124 Globemaster landing gear parts and struts. The welder also may be added to Douglas' RB-66 reconnaissance bomber production line. Power for the Douglas-specified tool is supplied by two 400-kva. transformers in parallel, one supplying current to the top dies, the other to the bottom dies. Maximum welding current is 110,000 amp. Welder is 32 ft. long, will accommodate work up to 12 ft. in length. Part is held in place with a 40-ton clamping force. Douglas says the machine will weld almost instantaneously bars or tubes of steel, titanium and other metals with joining area of up to 12 sq. in.

Tax Impact on Earnings

Aircraft Companies—Calendar or Fiscal Year 1952

	EFFECTIVE TAX RATE	EXCESS PROFITS TAX PER SHARE	REPORTED NET EARNINGS PER SHARE
Beech	65%	$1.07	$2.82
Bell	57	0.50	3.46
Bendix	70	4.16	7.22
Boeing	72	5.63	8.67
Cessna	71	1.02	1.59
Convair	51	0.35	4.39
Curtiss-Wright	57	0.13	1.02
Douglas	68	4.71	8.99
Fairchild Engine & Airplane Co.	70	0.47	1.36
Grumman	71	1.66	2.67
Lockheed	48	0.18	3.61
Martin	None	Nil	3.03
McDonnell	50	Nil	4.49
North American	62	0.58	2.28
Northrop	68	2.30	4.22
Republic	70	4.45	7.32
Sperry	73	4.48	6.75
Thompson Products	68	3.88	7.51
United Aircraft	65	2.36	5.18

SOURCE: Compam Annual Reports

NOTE: The maximum combined tax rate that can be assessed in any one year is 70%. Adjustments incorporated in company accounts pertaining to previous periods probably account for higher tax percentages shown in a few instances in the above table.

How EPT End Will Affect Aircraft

Death of excess profits impost will aid industry, but other government adjustments modify earnings too.

Taxes—particularly excess profits taxes—took the top off the aircraft industry's record reported earnings in 1952.

For this reason, the possible lapse of excess profits taxes on June 30, 1953, is of particular significance in viewing the earnings outlook for the aircraft builders. But even if excess profits taxes go, price redetermination and renegotiation will remain and continue to influence aircraft earnings to a major extent.

Compilation of earnings of 12 aircraft companies shows net income of $81.7 million for 1952, against $30.9 million for 1951, and surpassing the previous peak of $72.8 million established in the war year of 1943. Individual company results vary, of course, and requirements of the separate companies differ as to capital demands for expansion and research activities. An individual company cannot live on the industry average.

►**Subject to Change**—Moreover, there is a mistaken belief that reported 1952 earnings are final and conclusive. Actually there can be no such assurance.

In the first place, the contracting nature of the business is such that annual reports reflect accounting determinations comprising many elements which are of an estimated nature. Only after contracts are completed is a true measure of operating results known. Adjustments generally are taken into the accounts during the year in which the contract is completed rather than restating reported results of previous years.

Of greater importance are the price redeterminations and renegotiation processes that affect all military aircraft contracts.

▪ **Price redetermination** in recent years has been particularly severe for most aircraft companies. Involving individual contracts and coming relatively early, price redetermination is frequently reflected in current annual accounts, but by no means at all times.

• **Renegotiation** comes at the final stages and covers all military contract operations during a given year. This may not take place until years after the completion of a company's annual results. For example, the Renegotiation Board may not finish its review of 1952 results for most companies until 1954 or 1955.

Until a clearance notice is received from the Renegotiation Board reported results for the year in question have a tenuous note and must be regarded as tentative. Subsequent adjustments, if any, may be treated as a surplus adjustment or as part of the then current year's operations.

►**Excess Profits Tax**—The accompanying table, an exclusive compilation by AVIATION WEEK, shows the overall effective tax rate for a group of aircraft companies, together with reported net earnings per share after the stated amounts of excess profits taxes paid during 1952. The major bite of the excess profits tax is self-evident in virtually every case.

From a superficial viewpoint, some observers may expect all aircraft companies to benefit automatically this year if the excess profits tax is allowed to expire on June 30. This may be far from the case.

In the first place, 1953 earnings of the separate aircraft companies will feel the effect of excess profits taxes to a varying degree depending on whether they are on a calendar or fiscal year basis.

A calendar year company's earnings will be subject to the full 30% EPT, with the full year's results taxed at half the original rate (30%).

Companies with a non-calendar fiscal year will be subject to proportionately more or less EPT imposts. For instance, a Sept. 30 closing date will call for three quarters of 30%, or 22½%.

►**Final Analysis**—Of greatest significance, in the final analysis, retained earnings will be determined as final and conclusive only when the Renegotiation Board issues its clearance notices to the separate companies. Past experiences have demonstrated that there are no hard-set rules and regulations which guide the renegotiation processes. Circumstances and conditions change as do the composition of officials handling renegotiation.

For this reason, it may be highly premature to assume arbitrarily that the lapse of excess profits taxes on June 30 will bring automatic increments to aircraft earnings in the same measure as the tax relief.

—Selig Altschul

Ryan Doubles C-97 Aft Fuselage Output

CARGO LOADING BAY of Ryan built aft fuselage section for the Boeing Stratofreighter is built to take ...

PODS for inflight refueling on the KC-97 tanker version. The pods hold refueling operator and controls. Here they are seen bottom-side up during assembly.

AUTOMATIC RIVETERS are grouped compactly in new layout, to save space, improve tool utilization.

Ryan Aeronautical Co. has revamped its Stratofreighter production plans, almost doubling output of Boeing C-97 aft fuselage sections with only a slight increase in factory floor space.

The C-97's aft fuselage is a huge structure—38 ft. long and 11 ft. in diameter at its larger end. Its components are a large forward section, an intermediate smaller section, the tail cone, a set of clamshell cargo doors, and a large pod installation accommodating an operator and controls for inflight refueling.

▶**Squeeze Play**—When Ryan received production orders calling for a nearly doubled rate, its methods engineers began to study means to pare sharply the 35,000 sq. ft. of additional floor space that was at first considered necessary to do the job.

A new layout for improved parts flow, better assembly methods and more efficient handling fixtures were installed so that only 10,000 sq. ft.—13%—of added floor space would handle the big production load.

Ryan forms practically all of the thousands of parts that go into the aft fuselage. Previously, the formed parts were brought to each of the five major assembly areas, fabricated there into subassemblies. These subassemblies were built into intermediate assemblies which were incorporated into final assemblies making up the basic elements of the aft fuselage.

With this pattern of one assembly flowing into another, it was not possible to establish simple, straightline production methods.

▶**Operations Centralized**—Ryan methods engineers Harry Hollyome and John Roush improved the plan by centralizing the subassembly work according to type of assembly. Whereas similar types of work had been performed in each of the five assembly areas for different components, these operations now were brought together. Thus way a larger volume of work could be scheduled at a more uniform flow.

The new plan pulled some of the work farther from its immediate destination, but this disadvantage was far outweighed by boosted efficiency, Ryan claims.

▶**Riveting Grouped**—Grouping the subassembly operations makes it possible to get greater utilization of tools, personnel and supervision. Thus five of the Chicago automatic riveting machines are grouped in a compact circle. Loaded with rivets running from ¼ to ⅝ in., a large variety of small parts can be processed on the machines.

If these small parts were widely separated, Ryan claims, it would require many more of the automatic riveters and they would operate at lower load factors.

▶**Drill Rearrangement**—Previously, two radial arm drills for attaching holes in heavy bulkheads were operated in separate locations. Two of the assembly fixtures were accessible to one drill, while one fixture served the other. As a result, one drill was overworked while the other operated only a couple of hours per day.

Ryan moved the three fixtures together so that each drill can now serve two fixtures, affording a better work balance, higher tool utilization and higher production of parts.

▶**Frame Scheme**—The largest fuselage frame had been built in a big fixture which allowed only two employes to work on each assembly.

Now Ryan builds this frame in three parts, on benches, and uses the fixture for assembly only. With this scheme it can produce the frames at almost triple the former rate.

As a result of better accessibility, six workers can be devoted to this operation instead of two, each person performing a more limited number of operations for increased efficiency.

Assembly of the refueling pod has been cut by three hours by attaching the support bracket to the boom compartment before the unit is placed in the pod fixture. This allows more workers to perform the job simultaneously than could be accommodated within the pod.

▶**Floor Economy**—Mobile racks have been a big help in economizing on floor space. Some of these are used to carry the 23-ft. longerons and 7-ft.-diameter bulkheads, but also serve as temporary storage facilities, occupying much less space than dollies or trucks.

Extension of the upper deck of the platforms surrounding the large forward section of the aft fuselage has afforded temporary storage space for longerons, headers and large aluminum sheets.

Formerly, these items were stored on the factory floor, where they encroached on production space.

ROTATING FIXTURE used only for assembly operations, handles bench built aft-frame sections.

ON THE WAY giant aft fuselage sections are loaded on box cars at San Diego for shipment to Boeing and final assembly.

Plastic Tanks Will Save Aluminum

Aircraft fuel drop tanks will provide one of the major uses for glass-reinforced plastic laminates. In this application, they should save a substantial amount of aluminum and money.

Industry observers estimate that with the frequency of use involved in an all-out conflict, the aluminum tonnages for tanks might almost equal the consumption of this metal for airframes. And once these tanks are released over hostile territory, there is no salvage recovery.

Also, the aluminum unit for a fighter is reported to cost about $250 as against approximately $120 for the glass-plastic tank, which also is lighter.

▶**Fast Fabrication**—How rapidly these glass-plastic tanks are entering the aircraft picture is indicated in a report from reliable sources that Admiral Corp.'s Molded Products Division is readying for mass-production of 225-gal. Fiberglas-reinforced droppable units, with 10,000 of the tanks to be built within five months—at a rate of 2,000 per month.

The plan is to make it possible for

these tanks to be glued in the field, joining the end portions and center sections, with slight application of pressure. Epoxy resins would be used. Temperature is no factor in the assembly scheme, it is said.

The field assembly can be made in one man hour, according to reports.

▶**Mold Data**—Details on production equipment for the 225 gal. tanks have been revealed by Molded Products.

Three huge steel molds are being built by the company. Tank end and center portions will be constructed in 33 sections. The design is such that the molds can be altered to produce either 250-gal. or 200-gal. units by merely adding or removing sections.

Molded Products reports that the 225 gal. containers will be 180 in. long and 23 in. in diameter.

▶**Larger Tanks**—Another Fiberglas-reinforced fuel tank project is reported to be underway at Zenith Plastics Co., Gardena, Calif., under a development contract for 40 units of 450-gal. capacity. This droppable tank will be more highly stressed than a smaller, 225-gal. container. New presses will be required to handle production of these larger tanks.

Zenith's activities in the plastics field were outlined in AVIATION WEEK (Mar. 23, p. 42). The company has fashioned some of the largest reinforced plastic components ever produced.

▶**Plastic Planes**—The first "airplane" to be built entirely of Fiberglas-reinforced plastic probably will be the Air Force A-27 tow target scheduled to be pro-

MAGNESIUM BRAKE

Large magnesium casting—a speed brake for Chance Vought's twin jet F7U-3 Cutlass—will replace earlier aluminum alloy brake on the plane, with substantial savings in cost. The new unit, reported to be the largest of its type on any contemporary fighter, features an unusually thin shell for the area involved. Its light weight permits easy handling. Brake was cast by R. H. Osbnek Co., Los Angeles, whose activities in the thin wall magnesium casting field were outlined in Aviation Week (Dec. 29, 1952, p. 31).

duced by East Coast Aeronautics, Inc., Pelham, N. Y.

It is reported that about a dozen of these small all glass-plastic flying targets will be built. To promote interchangeability of sections only 5 molds will be used to produce 18 parts.

Beyond this project is seen the fibrous glass-plastic powered drone—the OQ-19—which probably will be built by Northrop Aircraft's Radioplane Division at Van Nuys, Calif.

▶**Highspeed Job**—High-temperature-resistant fibrous-glass reinforced construction for highspeed aircraft probably will not get its initial tryout in a plane proper. It is more likely that a missile will be the proving vehicle for this metal replacement scheme.

This type of application would supply the high speed, temperature and structural conditions to introduce the material for a new role in the aeronautical picture.

▶**Jato Study**—The fibrous glass-reinforced plastic also is being studied for possible applications in Jato bottles. Here, consideration is being given to construction of the bottle entirely of the plastic, except for the metal nozzle liner.

Operating conditions would expose the material to a very high temperature for only a short time. Although the glass-plastic would not have the temperature-resistance of steel, the short pulse of temperature plus the high insulating characteristics of the reinforced plastic would enable it to do the job.

PRODUCTION BRIEFING

▶**Perkin Engineering Corp.**, has moved into a new 10,000-sq. ft. plant at 345 Kansas St., El Segundo, Calif., to make standard and military laboratory and airborne d-c power supplies and associated electronic equipment.

▶**Heli-Coil Corp.**, Danbury, Conn., has established Resources & Facilities Corp. as its exclusive licensee under Heli-Coil patents throughout the world. The new firm will maintain offices in New York, Washington, London, Paris, and Tokyo.

▶**E. B. Wiggins Co.**, 3424 E. Olympic Blvd., Los Angeles, has leased an additional plant comprising 15,000 sq. ft. at South Pasadena. The firm makes couplings used in a number of manufacturing processes in aircraft and other industries.

▶**Piasecki Helicopter Corp.**, Morton, Pa., which has been buying the complete fuselage for its H-21 Work Horse from a subcontractor, soon will start making this major component itself. The move marks the first step in a program to curtail the firm's subcontracting program and to provide more jobs and steady employment at the home plant.

▶**Fletcher Aviation Corp.**, Pasadena, Calif., has concluded an agreement with Flymdustri Ltd., Oslo, Norway, for the latter to make auxiliary fuel tanks using Fletcher methods. Flymdustri now is making a British-designed tank but will switch to the U. S. model.

▶**Scott Aviation Corp.**, Lancaster, N. Y., and Firewel Industries, Buffalo, N. Y., are engaged in a joint engineering and development effort to supply military and civil oxygen breathing equipment and special apparatus.

▶**Aircraft Engineering & Maintenance Corp.**, Oakland, Calif., has been awarded a $3.5-million contract by USAF to recondition 68 Fairchild C-82 Packet cargo planes. The firm bid $1,150 per plane plus $3.23 per man hour.

▶**Chase Aircraft Co.** has awarded a contract to Daley & Co., Inc., Trenton, N. J., for building its $2-million plant at Mercer County Airport on a 54-acre tract leased from the county for 99 years.

Fast Writeoffs

Accelerated tax amortization for manufacturers expanding their defense facilities is granted by the government in the form of certificates of necessity.

Fast writeoff permits property to be depreciated in five years.

In the following list of recent certificates, company name is given, followed by product or service, cost of construction deemed necessary for defense expansion, and the percentage of the expansion cost allowed for fast writeoff.

- **United Aircraft Corp.**, East Hartford, Conn., aircraft engines & parts, $513,800, 65%.
- **Waldorf Instrument Corp.**, Huntington Station, N. Y., aircraft parts, $30,111, 70%.
- **Austenal Laboratories, Inc.**, Dover, N. J., aircraft components, $146,540, 65%.
- **Highland Tool & Die Co.**, Philadelphia, machining of aircraft parts, $62,016, 65%.
- **Vantool**, Philadelphia, machining of aircraft parts, $14,017, 70%.
- **Smith-Morris Co.**, Ferndale, Mich., aircraft parts, $150,550, 45%.
- **Surfinex Combustion Corp.**, Columbus, Ohio, aircraft parts, $333,200, 40%.
- **Tappan Stove Co.**, Mansfield, Ohio, aircraft parts, $210,047, 55%.
- **Pure Oil Co.**, Toledo, specialized facilities for aviation gasoline, $257,000, 100%; $53,100, 40%.
- **Oliver Corp.**, Battle Creek, aircraft parts, $197,370, 65%.
- **Lear, Inc.**, Elyria, Ohio, aircraft parts, $32,255, 60%.
- **Saffran Engineering Co.**, St. Clair Shores, Mich., aircraft parts, $1,025, 70%.
- **American Mineral Spirits Co.**, Toledo, aviation alkylate facilities, $3,673,203, 100%.
- **Cook Electric Co.**, Chicago, aircraft parts, $242,615, 50%.
- **Machinist Tool Co.**, Chicago, machining of aircraft parts, $9,750, 70%.
- **Ideal Roller & Mfg. Co.**, Chicago, aircraft parts, $120,275, 40%.
- **South Bend Screw Products**, South Bend, Ind., aircraft parts, $77,870, 65%.
- **Block, Sivalls & Bryson Inc.**, Kansas City, Mo., aircraft parts, $1,150,258, 45%.
- **Bendix Aviation Corp.**, Davenport, Ia., aircraft accessories, $133,051, 60%.
- **Hartwell Aviation Supply Co.**, Los Angeles, aircraft parts, $110,075, 50%.
- **Special Machine Tool Engineering Works**, New York, machining of aircraft parts, $22,493, 70%.
- **Konorr Machine Specialties**, Wilkes-Barre, Pa., machining of aircraft parts, $42,-695, 55%.
- **Eastern Air Lines, Inc.**, Miami airport facilities, $6,750,000, 60%.
- **National Airlines, Inc.**, Miami airport facilities, $200,000, 60%.
- **Piqua Engineering Inc.**, Piqua, Ohio, aircraft parts, $17,805, 70%.
- **Conforged Tube Products Co.**, Bellwood, Ill., aircraft parts, $250,000, 45%.
- **Chicago Forging Manufacturing Co.**, Chicago, aircraft parts, $71,500, 75%.
- **Trans World Airlines Inc.**, Chicago, airport facilities, $3,000,000, 60%.
- **Hussmann Aircraft Division**, St. Louis, aircraft parts, $420,000, 45%.
- **Cessna Aircraft Co.**, Wichita, aircraft, $325,000, 60%.
- **Danuser Machine Works**, Tulsa, machinery and aircraft parts, $8,100, 70%.
- **Phillips Petroleum Co.**, Phillips, Tex., special facilities for aviation gasoline, $54,-400, 50%; $51,000, 65%.
- **United Machine Co.**, Fort Worth, aircraft tools, dies, jigs and fixtures, $90,895, 45%.
- **Standard Oil Co. (Indiana)**, aviation alkylate, $1,595,600, 100%.
- **Cole Electric Co.**, Culver City, Calif., aircraft parts, $117,000, 45%.
- **Lockheed Aircraft Corp.**, Burbank, Calif., military aircraft, $101,000, 40%.
- **Lockheed Air Terminal, Inc.**, Burbank, Calif., airport facilities, $81,000, 60%.

SMALL STAMPINGS

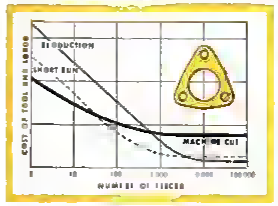
A COST-SAVING, VERSATILE APPROACH TO THEIR MANUFACTURE

Possibly you've always thought that a quick look at the quantity involved decides how a stamping shall be made. Sometimes it is done that way but it isn't the sure way to lowest costs.

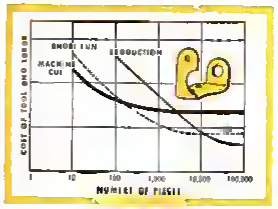
A more scientific approach by the STAMPINGS DIVISION of the Laminated Shim Company in Glenbrook, Connecticut frowns on the term "short run stamping." There is what is known as the short run *method* but there is no definite dividing point between short run and production quantities. Contour, tolerances, material, many other items all affect the manufacturing method when costs are being carefully figured.

NO ONE METHOD IS ALWAYS CHEAPEST; THREE ARE NEEDED

Machine-Cut Method. The STAMPINGS DIVISION goes one step further than Short Run and Production Methods. The Machine-Cut Method, though not strictly a stamping operation is a valuable addition to stamping procedure. Custom built shears, cutters, saws and files use experience-gained techniques to fashion the smaller quantities of parts. No dies are made, only stock punches are used. Obviously labor cost is understandably high but there is no tool charge.



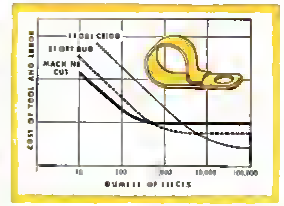
Short Run Method. As quantities increase (and depending upon the complications of contour, material, etc.) the economy of a temporary blanking die must be considered to eliminate the labor expense of machine-cutting. When this point is reached, manufacture is by the Short Run Method and the blanking is supplemented by other bench press operations. Here labor cost is at a medium level but a modest tool charge is incurred.



Production Method. As quantities increase the Production Method using standard dies with high speed automatic presses becomes more attractive. A relatively high tool charge can then be amortized over a great number of parts. Labor charge is negligible.

The Production Method as developed by the STAMPINGS DIVISION is offering unusual cost saving possibilities because of the new low-cost, full service Hechi type die developed by the company for certain applications.

It is interesting to note that sometimes a very small quantity of parts would require a standard die because of complications or close tolerances or tough materials involved. Thus occasionally a very small quantity goes into the production classification.



LOWEST COST IS ASSURED WHEN SUPPLIER HAS ALL THREE METHODS

The illustrations show typical stamped parts along with relative costs and breaking points for each of the three manufacturing methods. Unless a supplier can offer all three, his costs cannot always be low. For a given quantity, only *one* method can be most economical.

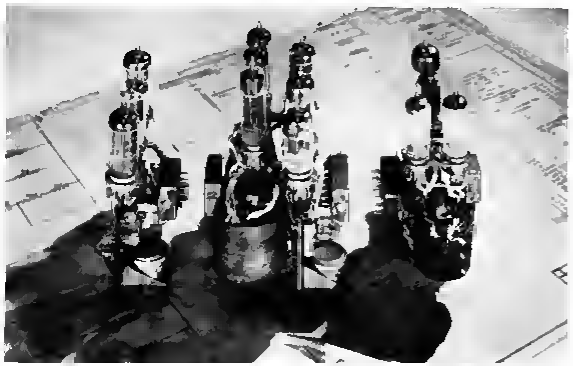
ONE OR ONE MILLION PARTS FROM SAME SUPPLIER

An important corollary to the above is that an experimental part in small quantities can be handled by the same supplier when full production quantities are needed.

Further, it is important that a supplier be fully informed, if possible, on later or total requirements for a given part. As the charts point out, such information will affect manufacturing method and make possible cost reductions.

FURTHER INFORMATION AVAILABLE

An illustrated 12 page brochure describing in greater detail the methods mentioned above is available on request to the STAMPINGS DIVISION, Laminated Shim Company, Inc., 5105 Union Street, Glenbrook, Conn.



PLANES USE more and more tubes. To keep down failures, industry military . . .

Teams Help Find the Right Tube

PET group cooperates with manufacturers to prevent misapplication of vacuum tubes in electronic devices.

By Philip Klass

The Research and Development Board's Panel on Electron Tubes (PET) is expanding its program to alleviate a major cause of electronic equipment failures—the improper use (misapplication) of vacuum tubes.

Under the PET program, a military contractor can obtain engineering assistance from a team of top experts on his own special vacuum tube problems.

▶**Military Cooperation**—The program, in which all three military services participate, was begun on a modest scale almost two years ago to assist manufacturers who had encountered troubles in production electronic equipments. The plan has recently been expanded and pointed toward preventing such troubles from arising by:

- **Analyzing prototype** or developmental equipment circuitry before it goes into production.
- **Publishing tube useage bulletins** to warn designers of possible tube application pitfalls and to point out techniques for avoiding these pitfalls.

▶**Consulting Teams**—Approximately 125 field trips have been made, or scheduled, to troubled equipment manufacturers since the program began, according to Prof. Walter R. Jones of Cornell University, who heads this phase of the program. Of the three military services, Jones says the Navy has made widest use of the consulting team service.

When a military equipment manufacturer needs assistance, he approaches the project engineer of the military service whose equipment is involved. The military project engineer then processes a request to the cognizant agency in his service for field consulting service. This agency transmits the request to Prof. Jones.

From a list of more than one hundred tube engineers "on call," Jones selects three, usually from three different tube manufacturers. The selection is influenced by the type of tube involved, the type of equipment, and the location of the troubled manufacturer. The military project engineer forms a fourth member of the consulting team.

▶**How It Works**—L. S. Schwartz of the PET secretariat described a team visit to a medium-sized Navy contractor. Upon arriving at the contractor's plant, the four-man team sat down at a conference table with the manufacturer's engineers, who described their troubles and went over the circuit diagram with the consulting team. The Navy project engineer acted as chairman during the group discussions.

After about four hours of discussion, the team was ready to make recommendations. One tube stage, troubled by excessive cathode leakage, should be changed to another tube type, the team suggested. The team also urged the manufacturer to add another tube stage to make the circuit less critical of tube characteristics.

▶**New Problems**—These recommendations raised new problems. The equipment was already in production and space inside the chassis was at a premium. The equipment manufacturer wasn't sure he could find room for another tube stage, but agreed to try. The Navy project engineer questioned whether needed quantities of the recommended new tube type could be purchased in time to meet the manufacturer's production schedules, but he agreed to check on this point.

Although manufacturers usually welcome the consulting team's suggestions, AVIATION WEEK was told, the recommended cures may be costly and result in production delays. It would be easier on the manufacturer and the military if tube misapplications could be caught while the equipment was still in the early stages of design.

This explains why PET has expanded its program to include "trouble preventive" field consultations. When a new piece of electronic equipment is under development, or ready for production design, a manufacturer may request his military project engineer to arrange for a team visit to look over the design for potential tube troubles. PET secretary Dr. H. E. Farnsworth expects this new phase of the program to attract considerable industry use.

Even the expanded field consultation service smacks somewhat of "locking the barn door after the horse is stolen." The real crux of the problem is to educate electronic engineers to apply tubes properly in the initial design. To do this, PET has started a program to prepare tube useage bulletins for electronic equipment designers.

▶**Tube Usage Bulletins**—PET is analyzing tube problems that come up during its field consulting trips to find those most frequently encountered. The most prevalent tube misapplication problems will be written up in individual bulletins.

The tube useage bulletin program has been started on a modest scale to determine industry interest in the idea. The first three bulletins, dealing with application of the 6X4 tube, voltage regulator tubes, and tube envelope temperatures, were published in the February, March, and April issues of Electronics magazine. Present plans call for the publication of one bulletin each month in Electronics.

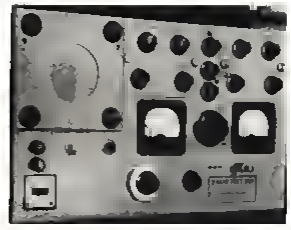
If industry interest justifies, reprints of these bulletins will be made available. Dr. Farnsworth says. Prof. Jones indicated that bulletins on additional subjects would be prepared and published in other magazines if the program proves sufficiently popular.

New Test Tools for Avionics Designers

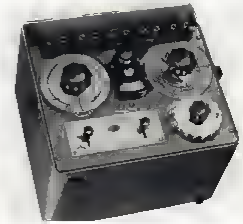
Laboratory test devices of interest to avionics equipment designers continue to come into the market. Some recently announced items include:

- **Oscillators.** Krohn-Hite Instrument Co. has developed three test oscillators covering different frequency spectrums. Model 400-C provides either sine-wave or square wave voltages between 0.009 and 1,100 cps. Model 430-A covers the range of 4.5 to 520 kc in five overlapping bands with a claimed calibration accuracy of ±2%. Model 440-A is a push button unit providing low distortion, stable-frequency sine- or square wave voltages between 0.01 cps and 100 kc. Three banks of 10 push buttons are supplemented by a continuous vernier control. Company address is 580 Massachusetts Ave., Cambridge 39.

- **Band-pass filter,** Model 310-A with unity pass gain and 24 db/octave slopes outside the pass band, has high and low cut-off frequencies which can be independently adjusted between 20 cps and 200 kc. This unit is also made by Krohn-Hite.
- **Radar tester,** combining functions of a signal generator, spectrum analyzer, power monitor and wavemeter for use in testing X-band radar is available from Electronics Division, Century Metalcraft Corp., Van Nuys, Calif.



- **Synchro "zero-er,"** Model U-101 for speedy and accurate zeroing (nulling) of either 400 or 60 cps synchros, either 26 or 115 v., has sensitivity of 10 millivolts according to Ultrasonic Corp., 61 Rogers St., Cambridge 42.
- **Impedance bridge,** Model 250-C1, capable of measuring resistances of 1 milliohm to 11 megohms within 0.1% capacitances of 1 µf. to 1,100 µf. within 0.25%, and inductances of 1 µh. to 1,100 µh. within 1.0% is available from Brown Electro-Measurement Corp. An associated oscillator-amplifier, Model 855-A1, can be used in place of batteries if 115-v. a.c. operation is desired. Brown's address: 4635 S. E. Hawthorne Blvd., Portland 15, Ore.



- **Wave analyzer,** Model 121, which operates between 15 and 500 kc, is designed to check filter characteristics or distortion in RF sources. Instrument sensitivity provides 3-db. attenuation of signals 100 cps. off resonant frequency, 10-db. attenuation of 200 cps. off resonance signals, according to manufacturer, Sierra Electronic Corp., 837 Brittan Ave., San Carlos, Calif.

Sadie

Converters Put Data Into Useful Form

Two manufacturers have recently announced similar devices designed to speed and ease the task of converting airplane, engine, and equipment test results into useful data. The devices, called analog-to-digital converters, automatically convert strain gage, thermocouple or analog computer output voltages into decimal digital form suitable for recording on punched cards, punched tape, magnetic tape, or for readout on an electric typewriter.

The two converters, one made by Consolidated Engineering Corp. and the other by Telecomputing Corp., both employ similar principles of operation. In each converter, a self-balancing potentiometer circuit, operated from three stepping switches or relays, is positioned to null out the incoming signal voltage. The position of the stepping switches determines the digital output signal. Both converters have an accuracy of one part in 1,000 (0.1%).

• **Consolidated Engineering Corp.'s Sadie** is available in a variety of systems made up of such components as a customer requires. The converter and its associated amplifier are separate components. Maximum sensitivity per digital count is quoted at one microvolt.

• **Telecomputing Corp.'s Teleducer** includes amplifier and converter in a single package. Sensitivity may be set at any desired value between 20 microvolts and one millivolt per digital count. Maximum time to convert a signal

Teleducer

voltage into digital form, read out, and reset, is 0.8 second, according to manufacturer.

Both manufacturers provide a visual light display showing signal voltage in digital form where manual read out is desired, or for monitoring.

Two New Connector Types on Market

DeJur Amsco Corp. and Monowatt have announced two new series of hermetically sealed connectors—one type rectangular, one circular.

• **Rectangular.** Available with either 14 or 20 contacts for use with #20 AWG wire, these new H20-series plugs will mate with the DeJur Series 20 receptacles. Designed for a breakdown voltage of 750 v. d.c. at 60,000 ft. altitude, or 3,000 v. d.c. at sea level, these plugs use a glass-to metal seal around each contact. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

• **Circular.** M-7500 line of connectors is designed to mate with standard AN(MIL) type of receptacle and has a breakdown voltage of over 1,000 v., according to manufacturer. A tapered, serrated surface enables the connector to be pressed into the chassis and firmly anchored. Hard-glass connector seal permits either soldering or welding to bond connector and chassis. Monowatt, 95 Hathaway St., Providence 7, R. I.

FILTER CENTER

▶ **Airborne Digital Computers**—There is additional evidence of the trend from analog-type fire control and navigation computer to automatic digital type computers first reported in AVIATION WEEK Dec. 29, 1952, p. 27. Engineering Research Associates (a subsidiary of Remington Rand) and the Massachusetts Institute of Technology, in addition to Hughes Aircraft Co., are now reported to be working on airborne digital computers.

▶ **IRE Avionics Group Expanding**—The IRE professional group on airborne electronics has nearly tripled its membership during the past year. K. C. Black, new chairman of the professional group, reported at its luncheon during the recent national IRE convention. Present count is almost 1,200 members, with local chapters in Dayton, Baltimore, Los Angeles and Philadelphia.

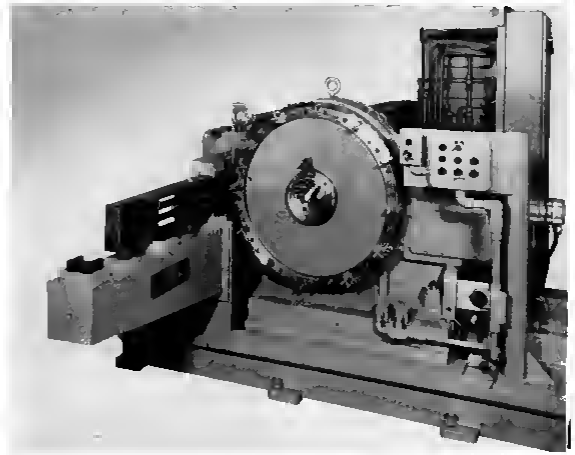
▶ **GE Ignition for Allison J35**—Allison is switching all models of its J35 jet engines to a new high tension capacitor-discharge ignition system developed by General Electric. A program to backfit J35s with the CE ignition is reportedly under consideration.

▶ **B-47 Intercom Troubles**—Boeing is currently encountering reliability problems with the new AIC-10 high-intelligibility intercom system now going into B-47s. Difficulties reportedly arise from the extremely subminiaturized construction used by RCA.

▶ **Classified Avionics Forum**—Air Arm Div. of Westinghouse Electric Corp. was host to 75 Air Force, Navy, and airframe manufacturers representatives recently in Baltimore at a two-day Annual Avionics Symposium, the first of its kind. Fourteen technical papers on classified avionics subjects were presented followed by discussion of mutual problems. Fourteen different aircraft manufacturers sent representatives.

▶ **Cite Airline Computer Need**—J. W. Allen, statistics manager for TWA, invited computer experts to propose methods and machines for obtaining airline operational statistics on a high-speed basis during the Midwest Research Institute's recent computer symposium in Kansas City. Allen cited need for computing equipment time, schedule time, crew scheduling, and traffic loads. —PK

NEW AVIATION PRODUCTS

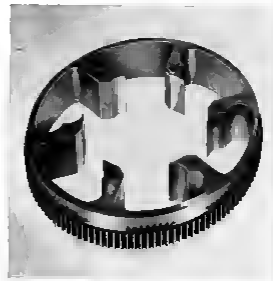


HORIZONTAL BROACHER cuts external slots and scallops on jet engine rings.

New Broaching Tools Handle Big Diameters

Broaching machines and new fixtures that can be adapted to standard machines are among recent developments at Colonial Broach Co. for machining of jet and piston engine parts.

Among these tools are two 10-ton models—one 60-in.- and one 90-in.-stroke horizontal broacher—for cutting out external slots and scallops on different types of jet engine rings. The 60-in.-stroke machine broaches three scallops on the ring with each pass of the ram. The 90-incher broaches a single dovetail slot with each stroke. Both machines are automatic.



INTRICATE PART needs special tool.

▶ **Operating Sequence**—The work shuttles to the cut and the ram starts. After completion of the stroke, the fixture moves away and the ram returns to starting position. The part is automatically indexed one increment and the process is repeated until all scallops or slots around the jet ring's periphery are done. Then the fixture moves to the loading position. Here, pneumatic or mechanical ejection of the finished part can be provided.

The machines are designed to permit mounting of large-diameter work. They can be shipped in three separate sub-assemblies which allows for ease of handling.

▶ **Internal Broacher**—Another development recently announced by Colonial is a fixture which enables the firm's standard 66-in.-stroke pull-down single-ram broaching machine to machine intricate internal countours of piston engine parts.

This fixture has two stations so that six identical contours between the internal lobes on the part can be broached in two passes of the machine, three alternate contours in the first pass, and the remaining three in the second.

Two stations are necessary to facilitate locating from the offset holes in the part. The part is shifted by hand to the second station which is shuttled into broaching position for the second pass. Twelve dowels in the fixture engage six holes in the work from above and below, providing firm support.

The side-shuttling fixture has a cen

tral opening through which the broach returns after each pass. All movements are controlled and interlocked by limit switches. The machine goes through one broaching cycle, then returns automatically. After the second station is loaded and in correct position, the machine is reactuated for the second pass.

Colonial Broach Co., Box 37, Harper Station, Detroit 13.

Transit Aligns Jigs

A transit for optical sighting in jig alignment and fixture construction activities, has been placed on the market by Warren-Knight Co.

According to the maker, the newly introduced instrument has been purchased by Glenn L. Martin Co., Kellett Aircraft Corp., and Fisher Body Division of General Motors. It is designed to assure precision control during the entire process of jig making.

The equipment consists of a 25X telescope mounted on U-shaped standards with clamp and tangent provisions, a special leveling head and lateral adjustor for speedy alignment and leveling, and a detachable and reversible striding level.

The telescope, 10 in. long, provides clear focusing to within 4½ ft., and resolution to 3 seconds.

Kellett engineers say that while they have used the instrument principally in construction of airframe jigs and fixtures, and in airframe alignment on prototypes and mockups, they also have found it "considerably faster than previous methods" for setting up large machinery. According to Kellett, relatively inexperienced personnel can be quickly trained in its use, and "in a very short time, can produce setup accuracies consistently within .010 in. in airframe alignment and down to .002 .0003 in. on fixture construction."

Warren Knight Co., 136 N. 12 St., Philadelphia.

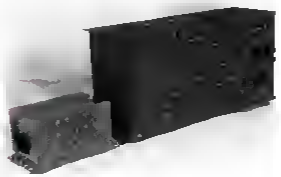
Aircraft Plastic

Strux, a lightweight, high-strength cellular plastic with a number of aircraft applications, is now being produced in a wider range of sizes and shapes than previously and at lower cost through use of new machines and production techniques by Strux Corp.

The product, also known as CCA (cellular cellulose acetate), is used for reinforcement of aircraft control surfaces, helicopter blades, radome housings, floor and wall paneling in fuselages, as the core in sandwich materials, or for filler blocks under fuel cells.

Strux is lighter than balsa wood, but stronger, having a compressive strength of about 200 psi, the company says. It can be subjected continually to temperatures of 350F, or higher when used with glass laminates. The product floats and is unaffected by aviation gasolines, and can be bonded to glass cloth, glass mat, metal or wood with polyester resins.

Strux Corp., Lindenhurst, L. I., N. Y.



Circuit Balancer

A 15-channel balance panel for use in flight test instrumentation and other applications where multiple channel data recording is required has been developed by American Helicopter Co., Inc.

The set, Model BP 2, is made up entirely of miniaturized components so that it may be used in missiles, fighters and small planes. It can be used for electrical balancing of circuits involving strain gages, accelerometers, position pick-ups, or any sensing devices that operate on electrical bridge circuits.

The instrument employs miniature 10-turn balancing potiometers having a linearity of 0.5%.

The unit's precision, wire wound resistors for calibration have an accuracy of 0.1%. They are said to have zero temperature drift through the range from −40 to 250F. A miniature, 10-position rotary switch is used in conjunction with the calibrating resistors.

Panel on the unit is equipped with one output and two input plugs, each having 34 pins. The set weighs 1.5 lb and measures 6×3×3 in.

American Helicopter Co., Inc., 1800 Rosecrans Ave., Manhattan Beach, Calif.

ALSO ON THE MARKET

Superfine bore surface and accuracy, previously unobtainable with standard production tools, is said to be provided with Floating Reamer developed by Wickman Mfg. Co., 10325 Capital Ave., Detroit 37, Mich.

Internal grooves in bores of by-pass reliefs in hydraulic mechanisms and other components can be measured accurately with gage probes the new instruments are small enough to enter 3/10 in. bore and measure groove diameters for O ring AN6227-6 and snap ring groove NAS-50 31.—Rimat Tool Co., 21 W. Dayton St., Pasadena 2, Calif.

Machine tool vise and jaw kit eliminates complicated clamping arrangements permits quicker, more accurate set-ups and rapid unloading and loading of jig borers, millers, planers and shapers simply by loosening one adjusting screw.—J&S Tool Co., Inc., 644 W. Mt. Pleasant Ave., Livingston, N. J.

Huck Lockbolts are now available in a broad head series designed for fastening wood to metal, producing the tightness of rivets and the strength of bolts, the company says.—Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, Mich.

Paragon Sub Presses combine punch and die in one assembly. A number of assemblies can be placed on bed as desired, speeding set-up and avoiding need of ram attachments on large punch presses and similar machines.—Price Machine Products, 929 W. 80 St., Los Angeles 44, Calif.

Carbon dioxide is discharged faster from portable fire extinguishers fitted with recently developed speed valve that disassembles without special tools and operates under finger pressure.—American-LaFrance-Foamite Corp., Elmira, N. Y.

Subminature switch for guided missiles, compact avionic installations and controls in aircraft has 2½- to 5-amp capacity in 30-v d-c and 125/250-v, a-c systems, small movement differential enables it to give accurate control when actuated by bimetal temperature elements or sensitive diaphragms.—Electro-Snap Switch & Mfg. Co., 4218 30 W. Lake St., Chicago.

Improved hydraulic bending machine provides more even distribution of stress and strain during bending operations through newly designed table which gives steadier, stronger base and keeps parts aligned more accurately.—O'Neil-Irwin Mfg. Co., 516 Eighth Ave., Lake City, Minn.

DEPRECIATION

And Its Crucial Economic Role

The sixth annual McGraw-Hill survey of Business' Plans for New Plants and Equipment, just completed, reveals some remarkable facts about the role of depreciation in our economy. To most people, depreciation is a technical term, used by accountants to discuss a dull subject. But it really is a simple matter. It is the amount of money set aside each year by a company to replace plant and equipment that is wearing out. And here are some facts from this survey* which show how depreciation can make the difference between prosperity and recession in the United States:

1. *In 1953, about half of all the money spent on new manufacturing plants and equipment will come from depreciation reserves.* For the future, manufacturing companies are relying even more heavily on this source of money. In the years 1954-56, they count on using their depreciation funds to pay for almost two-thirds of the new plants and equipment now planned.

2. *The amounts of money made available by depreciation allowances vary greatly from industry to industry.* Some industries, such as those producing steel, chemicals and petroleum products, will have relatively large amounts of cash available from their depreciation reserves. In considerable measure, this is because the government is allowing them to accumulate such reserves at an accelerated rate as an encouragement to build facilities required for national defense. But most of the companies engaged in the production of textiles, processed foods and many kinds of machinery have had little chance to benefit by this provision for accelerated depreciation. Hence, they have much less money available from depreciation reserves.

3. *There is a definite shortage of investment funds in the industries that have relatively low depreciation allowances.* Taken together, the coal mining, textile, food processing, machinery and other metal-fabricating industries plan to spend about $4.7 billion for new plant and equipment this year. But they report that they would spend $1.5 billion *more* per year during the period 1954-56 if sufficient funds were available.

4. *Eighty-five per cent of the manufacturing companies covered by the survey reported that they plan to invest all their depreciation funds* to keep equipment up-to-date and to provide capacity for new products and new markets. These companies could let their depreciation funds pile up as idle cash. But the intention is to spend most of them for capital equipment.

*The sixth annual McGraw-Hill survey of Business' Plans for New Plants and Equipment included companies that provide 25 per cent of all industrial employment and 60 per cent of employment in those industries where capital investment is highest. These companies are mostly the larger companies in their respective industries. A copy of the full report of this survey can be obtained by addressing Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York 36, N. Y.

Hence, there is a direct relationship between the amount of depreciation funds available and the level of capital investment. And it is upon the latter that the level of general prosperity decisively depends. One-third of all industrial workers are engaged in producing or installing such equipment.

This fact that the level of depreciation allowances has a major bearing on the level of capital investment should not surprise anyone. In several foreign countries where these allowances have been increased, investment has boomed. The two nations with the highest ratios of investment to national income are Canada and Norway. Both countries adopted flexible depreciation policies after World War II. In Sweden and The Netherlands also, flexible depreciation allowances have contributed to rapid industrial expansion. Finally, the tremendous investment brought about by our own rapid amortization program shows dramatically the importance of depreciation in stimulating capital expenditures.

Obsolete Tax Laws

In spite of this record, the fact remains that our laws and the business procedures that govern depreciation allowances—in particular the laws and rulings that govern the deduction of depreciation from taxable corporate income—are still based on antique and obsolete accounting concepts which take no account of depreciation's dynamic role in our economy. The internal revenue code still requires most companies to depreciate their equipment over a long period, even though these small annual allowances cannot possibly pay for the investment that is necessary to keep a plant up-to-date under today's rapidly changing technology, with its production of new and improved machinery.

The only allowance made by the government for rapid depreciation is that which is authorized for certain types of plants during the defense emergency. Under this policy most companies are unable to use accelerated depreciation for tax purposes. And as defense projects are completed, the number of new authorizations is dropping. We may lose the chance to utilize fully this powerful tool for sustaining investment because, under our ramshackle emergency tax structure, accelerated depreciation is available only to a minority of firms on a temporary basis.

New Policy Needed

A sensible, up-to-date depreciation policy for tax purposes is long overdue. Either the Treasury must modernize the internal revenue code on its own initiative, or Congress must take the lead by writing into permanent law a flexible depreciation policy applicable to all companies.

Treasury experts now have before them a number of proposals to allow faster depreciation for the average firm. The U.S. Chamber of Commerce has suggested that companies be allowed to deduct from taxable income 25 per cent of the cost of new equipment in the first year, with the remaining cost to be deductible over the life of the facilities. The Machinery and Allied Products Institute has long sponsored a formula that would allow full deduction in two-thirds of the estimated life of the property. In Congress, Chairman Reed of the Joint Committee on Internal Revenue Taxation has stated that we need a more flexible depreciation policy. Senator Frear of Delaware has introduced a bill that would let a business make its own choice on how fast to depreciate its equipment.

It will take time and study to determine which of these various proposals best fits the needs of the economy without sacrificing unduly the revenue needs of the government. If we are to have a new depreciation policy, designed for a long period ahead, it must be carefully worked out. But this much is clear right now: *The development of a flexible depreciation policy on the part of the federal tax authorities is one of the most important steps that can be taken to sustain prosperity. When we talk about depreciation, we are talking about the money that pays for almost two-thirds of the new manufacturing facilities now scheduled for construction. We are talking about the new investment and the new jobs on which our continued prosperity depends.*

McGraw-Hill Publishing Company, Inc.

Court Upsets CAB Airmail Rate Formula

- **Ruling threatens profits of seven U. S. carriers.**
- **But Supreme Court will make final decision.**

By Lee Moore

The U S court decision against Chicago & Southern Air Lines and Civil Aeronautics Board on mail rates threatens profits of seven American carriers with international routes Braniff, Colonial, Delta-C&S, Northwest, Pan American, TWA and United

If upheld by the Supreme Court, the decision could spur the following action

• **Civil Aeronautics Act** amendment to permit CAB to continue setting separate mail rates for foreign and domestic routes of one airline—the traditional mail-rate formula upset this month by the U S Court of Appeals, District of Columbia

• **Subsidy separation** legislation

• **Route sales** by domestic airlines to unload the threatened burden of international losses on their domestic profits

• **Carrier re-organization,** setting up domestic and international systems as separate companies to achieve the same result as route sale

However, since the appellate court judges split two-to-one, some observers forecast the Supreme Court may overrule, or at least modify, the mail-rate decision

▶**C&S Case**—The Board recently fixed final mail rates, mostly non-subsidy, for virtually all airline domestic systems. Stockholders therefore, pinned their strongest hopes on the domestic system of each carrier to yield increasing non-subsidy profits without undue risk of government recapture.

But in the case at issue, the court supported the claim of the Post Office Department against Chicago & Southern and CAB The Board sets the amount of subsidy, and Post Office pays it. Postal authorities wanted CAB to use the domestic profits of C&S to help offset the subsidy need of its separate international division

▶**General Effect**—If the Supreme Court goes along with this, Post Office may recapture domestic earnings of more than 8% to offset subsidy of many international routes That certainly would hit back mail rates paid to a few of the airlines for international services

The big question not yet clarified by the courts is whether this doctrine also would apply to airlines with domestic systems entirely off subsidy If the ruling applies to these carriers, it could depress the earnings of all those airlines which have subsidized international routes

▶**Court Opinions**—Judges David L Bazelon and James M Proctor interpreted Section 406(b) of the Civil Aeronautics Act as requiring CAB to treat Chicago & Southern as one indivisible whole in setting subsidy mail rates The pertinent clauses of the act state that, in fixing mail rates, CAB shall "take into consideration the need of each such air carrier . . ."

The judges apparently reasoned that an airline can't keep excess profits on one route and still get the "fair and reasonable" mail subsidy rate on another route

But Judge E Barrett Prettyman dissented He said the act only requires that CAB "consider" the need of the company as a whole But the Board has final discretion on how and what rates are fair and reasonable for development of the air transport system Judge Prettyman's dissent will be a major point in the appeals filed by Chicago & Southern and CAB to the Supreme Court

▶**Impact on Airlines**—Here is the potential effect of the court order on individual carriers as seen by airline and Board officials

• **Delta-C&S** would get a lower international mail rate than CAB originally proposed for Nov. 1, 1946-Dec. 13, 1950—the period covered in the court case of Post Office v. CAB and Chicago & Southern But the future effect on Delta C&S and TWA, Braniff and Northwest depends on whether the courts interpret the new doctrine as applicable to a domestic route system even after it is off subsidy operation entirely

• **TWA Atlantic Division** mail rate is open from 1946 forward, and the final rate is slated for oral argument before CAB later this year A TWA spokesman says that in the Big Four domestic mail rate case, CAB admitted Trans World earned approximately 2% on its 1946 50 domestic investment So the new court doctrine may not hit TWA for the back period. Since 1950, however, TWA has earned good profit on a non subsidy domestic rate

CAB attorneys question whether the courts could insist that non-subsidy revenues be used to offset subsidy need of an international rate If the courts do insist on that extreme interpretation, the impact would be hard on current and future earnings of TWA and other airlines

• **Braniff international** mail rate is open from 1948 forward Some CAB officials believe application of the court doctrine would offset some domestic profits against 1948-52 international need Braniff went on a non-subsidy domestic rate recently but also immediately asked to go back on some subsidy to help carry the Mid-Continent route acquired last year If the carrier's domestic earnings from 1953 forward drop as much as its subsidy application implies, Braniff should have no further problem from provisions of the court doctrine for a time

• **United's Hawaiian** route would drain some of the airline's domestic earnings for part of the 1947-52 back period, some CAB officials believe. The international route has lost money since

Impact of Airmail Rate Ruling*

Potential losers:	Unaffected:
Chicago & Southern, 1946-50	American
Delta C&S, May 1953 forward	Eastern
TWA, 1946 forward	National
Braniff, 1948 forward	Panagra
United, 1947-52	
Northwest, distant future only	
Colonial, distant future only	

(Note Pan American, 1946 forward, would have a mixed loss and gain)

*Court of Appeals, Washington, D C. decision that CAB must apply profits of one division of an airline to help offset subsidy need of another division

UAL put Stratocruisers in service two and a half years ago. The domestic route earned more than an 8% return in the same period. The court doctrine might take some of United's domestic earnings to help carry the Hawaiian Stratocruiser operation. Last August, CAB placed UAL's Hawaiian route on a non subsidy rate, so the potential impact of the court doctrine on UAL ends with the 1947-52 period.

• **Northwest** is on final domestic and international mail rates now. Only the year 1951 is open and since both domestic and international subsidy rates are under consideration in that back period the court doctrine does not apply. When the international rate is reopened the domestic offset problem may arise. Even then, there will be no problem if the court meant a non-subsidy domestic rate should not be required to help carry the international rate.

• **Colonial** current and past mail rates both are final, therefore the court doctrine would have no immediate effect. Colonial is the only airline whose International (Bermuda) Division mail rate is lower than the domestic. In this case, the court doctrine would require application of international profits to help subsidize a domestic route of the same carrier.

• **Pan American** has four separate international routes, of which two are on final mail rates and are earning 5% and more on investment. The court doctrine would hurt PAA by requiring CAB to use profits of the Pacific and Alaska Divisions to lower the rates finally set on the Latin America and Atlantic Divisions. But the immediate impact would be relatively moderate because the Latin America and Atlantic Divisions are much larger than the other two.

Furthermore, all four of Pan American's divisions are on subsidy. Their earnings will be held to a modest return while the domestic divisions of PAA's competitors—TWA, Northwest, Braniff, C&S, Colonial and United—have a higher profit potential. Therefore, some Board officials speculate that Pan American might gain indirectly under the court doctrine by competitors' greater loss. The court doctrine, in effect, would bring six competitors down to PAA's earnings by putting them overall operations back on a subsidy basis.

• **Other international airlines.** American, Eastern, National and Panagra, have one company division only and, therefore are unaffected by the court doctrine.

Resort Airlines Gets New Management

Walter Sternberg, National Airlines vice president-sales since 1949, becomes president of Resort Airlines June 1, and industry observers are forecasting new growth for the small carrier through a combination of his sales methods, Resort's 10,000 mi. of vacation land routes and the financial backing of billion dollar Fiduciary Counsel, Inc.

▶ **Sternberg**—Before joining National, Sternberg was assistant vice president-sales for American Airlines and previously was general traffic and sales manager with Eastern Air Lines.

He has been associated with development of several successful airline promotion programs including the original family fare plan of American Airlines. With National, he was instrumental in development of that airline's "million dollar vacation on a piggy bank budget," the "fly and drive" car rental promotion, daylight aircoach, the "luxury 'Stars'" service and National's industry-location service aimed at bringing more businesses to Florida.

▶ **Resort Airlines**—Resort is certificated to offer package air tours over 10,000 route miles from New York, Miami and other East Coast centers to the Caribbean and Latin America vacation lands and the Canada-Nova Scotia playgrounds. The certificate forbids regular, point-to-point service. It is a tour airline only, except that CAB and the courts have ruled that Resort can do what it wishes on a charter basis, just like any other certificated airline. The certificate requires that each tour stop at a minimum of three places on the airline's international route system.

Last week Resort started invading a portion of Eastern's and National's Miami vacation market by arranging seven-day Miami stopovers on its two-week Caribbean, Central America and Mexico tours. Eastern, National, Delta and others will protest in hearings slated this summer at Civil Aeronautics Board.

Resort argues that since its certificate requires at least three different foreign stops on any tour, the cost is substantially higher than package vacations offered by Eastern and National to Miami alone, and therefore is not directly competitive with them.

Resort presently has 14 C-46s in operation.

▶ **Fiduciary**—Fiduciary Management, Inc., bought 90% of Resort in 1950. It is an offshoot of Fiduciary Counsel, Inc., which handles investments for many wealthy estates. Fiduciary Counsel concentrates on development of new enterprises, sometimes sets up separate investment groups to operate them. Fiduciary Management, which controls Resort, is one of the latter. Chinton Davidson, Jr., son of Fiduciary's founder, is board chairman of Resort.

ASA Elects Castleberry

Winston Castleberry, vice president-services for Southwest Airmotive Corp., Dallas, has been named to the board of governors of the recently organized Aircraft Service Assn., Inc.

ASA is made up of operators of privately owned aircraft and engine maintenance facilities. Its primary purpose is to promote recognition of their value to national defense. Member firms represent facilities with a capital investment of more than $112 million and an annual work capacity of 54 million man hours.

NEWARK AIRPORT'S NEW TERMINAL

Aerial view of the new $8.5 million passenger terminal structure, on the northern edge of Newark Airport. It is scheduled to be opened in July. The building is approximately five times the size of the present terminal. There will be 16 plane gate positions, which can be expanded at some later date to 22.

Nonskeds Find Favor at Hearing

Senate committee is expected to uphold irregulars' right to compete in U. S. domestic air transport system.

Scheduled and irregular air carriers fought a long but indecisive word battle over which should operate the mushrooming aircoach business at a series of sessions before the Senate Small Business Committee.

The committee has been sympathetic to the position of the nonskeds, giving them full credit for initiating the development of aircoach and air cargo transportation on a large scale.

▶ **Middle of the Road**—Under the chairmanship of Sen. Edward Thye, the committee is expected to take a somewhat more middle-of-the-road stand. Nevertheless, it is expected to continue to insist that Civil Aeronautics Board allow nonskeds to remain in the transportation system.

The hearings drew a good showing of senators. Among those participating in addition to Thye: Leverett Saltonstall, Guy Cillette, John Sparkman and Lester Hunt.

Two former senators appeared for the nonskeds: Joseph O'Mahoney, representing North American Aircoach Systems, and Claude Pepper, representing Air Coach Transport Assn.

Both sides claimed credit for developing aircoach. Sharp charges were tossed freely. But there was agreement on one point: "Nonsked" and "irregular" are misnomers. Certificated carrier spokesmen protested that operations of the uncertificated carriers are neither "unscheduled" nor "irregular." Pepper objected that "irregular is a damning word to anyone in the airline business—or to anyone in any business." He requested "supplemental aircoach carriers" be substituted.

Speaking for the nonskeds:

• **Former Sen. Pepper** urged the committee "to use its utmost power" to stop CAB from putting uncertificated carriers out of business and to permit carriers already forced out to resume operations until overall policy on their role has been worked out. He also said that the Board should "rid itself of the erroneous concept that the supplemental carrier by air must be an irregular carrier. The word is unfair, not at all symbolic of the service furnished, and its very continuation will deny the mass of American people an air service which they can afford—while in no way affecting adversely the so-called regular carriers."

• **Former Sen. O'Mahoney** made a 40-page presentation to show that "Congress has repeatedly expressed reservations about or strong displeasure at the failure of CAB to give effect to liberal entry of new enterprise into aviation." He said legislation may be necessary "to prevent the complete domination of the air by the present small group of certificate holders."

• **Hamlin B. Johnston**, general manager ATCA demanded that Louis W. Goodkind, now serving as CAB counsel in the investigation of non-certificated operations, be subpoenaed by the committee "and made to tell all the facts." As chief of CAB's Bureau of Economic Regulations in 1948, Johnston charged, "Goodkind laid out a master plan for driving America's small airlines out of business." Johnston protested that "CAB has misconstrued the term 'public interest' in the Civil Aeronautics Act to mean the financial well being of subsidized carriers rather than the public they serve."

• **Ramsay Potts**, president Independent Military Air Transport Assn., argued that figures refute the certificated lines' claim that nonsked operations have skimmed the cream of their business. He pointed out that domestic trunklines' passenger revenue jumped from $166 million in 1945 to $669 million in 1952.

• **Howard Hunt**, secretary-treasurer Air Transport Associates, testified that in eliminating non-certificated carriers, CAB has "substituted 'death by delay' through expediting enforcement actions while delaying certificate and exemption proceedings." The Board, he said, "has apparently finally succeeded in putting Air Transport Associates out of business a bare couple of months before it would have to consider the firm's four-year-old certificate of application, filed in May 1949."

• **James Fischgrund**, vice president NAACS, claimed the failure of the scheduled lines to increase earnings by expanding coach services during the 1946-49 industry depression cost the taxpayers many millions of dollars in mail pay.

• **O. Roy Chalk**, president Trans Caribbean Airways, suggested that irregulars be restricted to a maximum mileage per month, possibly 120,000, and limited to six roundtrips monthly between the carrier's base and any other of six domestic or overseas areas. He also recommended that the government assist in financing airline equipment purchases.

• **Coates Lear**, vice president Overseas National Airways, said irregulars flying the Korean airlift in 1951 were paid an average of $1.44 per mile compared with $1.61 paid the scheduled carriers. He said if Overseas National had been paid the scheduled rate it would have received more than $5.2 million, instead of the $3.7 million.

• **Maj. Gen. Hugh Knerr** (USAF Ret.), urged promotion of irregular and freight operations, saying that "with an industry that is able to support 10,000 DC-4 equivalents we will have barely met the requirements of the military for airlift in an all-out emergency."

Speaking for the scheduled carriers:

• **J. H. Carmichael**, president Capital Airlines, objected that CAB restricted the carrier's New York-Chicago aircoach service, while permitting nonskeds to increase operations over the route. "It is paradoxical that Capital, operating

DELTA-C&S TRADEMARK

First plane to carry recently merged Delta-C&S Air Lines' new markings is this Convair 340. The company's new insignia is visible on the plane's nose and on the tail, while the engine cowls carry the word "Delta." The two carriers, having a combined system of 9,508 mi., were joined May 1. Fleet consists of 7 DC-6s, 6 Constellations, 31 DC-3s and 20 340s (some yet to be delivered). Four DC-7s, costing $7 million, are scheduled to be delivered some time early next year.

under a duly authorized certificate, should be removed from a service it pioneered, while a group of carriers operating with no certificate authority should continue to increase service in the same market . . ."

• **Robert Ramspeck,** vice president Eastern Air Lines, reported more than $5 million of Eastern's 1951 revenues were diverted by irregular carriers operating in competition on the New York-Miami segment

• **George Hatch,** manager Northwest Orient Airlines, claimed irregulars on the Seattle-Alaska run "have followed a practice of holding fares just under the regular scheduled fares and of providing service only during profitable periods of operation "

• **Warren Lee Pierson,** board chairman Trans World Airlines, characterized the industry as "one of the most intensely competitive in the nation " He acknowledged that there is a place for the nonskeds, particularly in charter service, military contract work and unusual flight movements But Pierson warned against permitting a large number of irregulars to continue to serve the long-haul high-density segments

• **W. A. Patterson,** president United Air Lines, told the committee that nonskeds "should not be given any special privileges or misguided sympathy on the basis of their strong protestations about 'pioneering,' 'small business,' 'persecution' " He said "regular irregulars" have continued "to flaunt the law by various combines, by switching names, through split organizations, interlocking relationships and by many another subterfuge "

• **C. R. Smith,** president American Airlines, said "the basic airline industry should be regulated in its entirety It cannot be half regulated and half non-regulated There could be no effective nation wide system of airlines if each company were free to abandon service to smaller cities " He asserted the irregulars have substituted the plea "small business" to get favored treatment for the cry of "veterans" they used immediately after the war

• **Alexander G. Hardy,** executive assistant National Airlines, reported that National "was straining every muscle" to get into aircoach service as far back as 1948 when there was no other substantial New York-Miami coach service, but was barred by CAB

• **John C. Leslie,** vice president Pan American World Airways, challenged nonskeds' claim to pioneering in aircoach He pointed to PAA's 1942 annual report foreseeing a developing market for low-cost service after the war and Pan American's plan to operate $99 transcontinental service in 1946

Three Major Airlines Double Net Profits

Total first-quarter net profits of the Big Four domestic airlines gained 65% over a year ago April and May passenger-mile volume is running 25% ahead of the same months last year

American Eastern and TWA domestic profits almost doubled But United's first-quarter profit dropped substantially from last year, largely due to cost of introducing its new Convair fleet

▶ **Rail Profits Drop**—In sharp contrast to the airline upswing the railroads report continued decline in passenger revenues Pullman dropped 9% and inter-city rail coach 1% in January

New York Central has announced plans to discontinue some trains in 1953 The railroads have proposed legislation enabling the Interstate Commerce Commission to override state utility commissions that refuse to let rail carriers end uneconomic services

▶ **Gains Continue**—While airline revenues are up 10-30%, profits gained even more in the first quarter this year because 1952's Newark crash series and airport shutdown depressed business, added to costs Favorable year-to-year comparison should repeat in the second quarter to a lesser extent because of continued high volume and last year's gasoline shortage in May

Capital Airlines, often bellwether of smaller more marginal lines, reports a 29% gain in revenue passenger-miles during the first four months of 1953

Wright Modifies Turbo Compound for Safety

An engineering fix is being completed on the Curtiss-Wright R3350 Turbo Compound 3,500-hp engine to safeguard against turbine blade failures in flight

The modification was necessary before Civil Aeronautics Administration would accept the engine for certification on the Lockheed Super Constellation 1049C transport

The fix involves

• **Installation** of an armor plate ring around each turbine wheel to prevent failing blades from causing damage externally

• **Drilling** a hole in the root of each turbine blade so that they will fail at an overspeed condition of 25,000 to 26,000 rpm

• **Improvement** of cooling passages to prevent exhaust gases from mixing with cooling air and causing turbine overheating (AVIATION WEEK May 4, p 7)

The modification was considered necessary, CAA engineers say because of several military aircraft incidents when blades in the three small turbines attached to exhausts broke during flights and in ground runups, causing considerable damage to engines and airplanes These incidents have been reported on the Navy Lockheed P2V Neptune Patrol Bomber and the Air Force Fairchild C-119 Packet cargo plane, both equipped with the Wright Turbo Compound

The shielding ring is a high-strength steel alloy, approximately ¼ in. thick and about 2 in. wide, fitted around the turbine wheel

The hole is drilled near the point where the blade root is attached to the turbine wheel Increasing the margin between design fail speed and operating speed will decrease revolutions per minute from 21,000 to 19,000, CAA reports

First of the turbine wheels with drilled blade roots are about ready for shipment to Burbank for installation in Turbo Compound engines on the Navy Lockheed R7V-1 Super Constellation which is in the process of being completed

Radar for Geneva Field

(McGraw-Hill World News)

Geneva—Swiss authorities have decided to install precision approach radar at Cointrin (Geneva) Airport after comparative trials with search radar equipment Topographical conditions ruled out the SRE gear

SHORTLINES

► **Air France** is conferring with SNCASE, Sikorsky licensee in France, on possible order of four to six Sikorsky S-55 helicopters for commercial use.

► **Air Transport Assn.** says loss or damage to airfreight by nation's scheduled air carriers during 1952 was reduced to three-fourths of one cent on every dollar of freight revenue received.

► **Allegheny Airlines** carried 13% more passengers last month, boosting revenues 15% higher than April 1952.

► **Eastern Air Lines** had the best April in its history last month, flying an estimated 243 million passenger-miles, a 30% increase over April 1952.

► **Honolulu International Airport's** proposed new $5 million terminal is being opposed by both Pan American World Airways and United Air Lines as part of their fight to get a reduction in the territory's four-cent-a-gallon aviation fuel tax.

► **Leavens Bros. Air Services, Ltd.**, has been recommended by Civil Aeronautics Board for a temporary irregular foreign air carrier permit for three-year period . . . Will provide occasional service between Toronto, London, Windsor and Leamington, all in the province of Ontario, Canada, and points in Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York.

► **North Central Airlines** will increase service 20% beginning June 1, now has 14 DC-3s in its fleet.

► **Oakland Municipal Airport** outbound passenger traffic in March increased 43.6% over a year ago.

► **Pan American World Airways** and U. S. government have cooperated in designating San Juan, P. R., as a pre-clearance port for New York-bound passengers.

► **Provincetown-Boston Airline** began its fourth season of scheduled operation between Boston and Cape Cod May 15, flying a Lockheed Electra and two Twin-Cessnas. During 1952, the airline carried 5,044 passengers over its 48-mile route.

► **Scandinavian Airlines System** began new DC-6B biweekly service May 17 between Goteborg, Sweden, and New York via Stavanger, Norway, and Prestwick, Scotland.

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Exterior Lighting

Once upon a time all good airplanes sported a red a green and a white light Later they were made to blink Then more lights were added Now, we have white lights below and on top of the fuselage a red light in the leading edge of the left wing, a red or white light in the nose, lights which illuminate the leading edges of the wings, landing lights mounted either underneath or in the leading edge of the wings and several homegrown varieties of oscillating, rotating or flashing beacons In addition, some military planes are equipped with amber and blue lights for special purposes, and lighted helicopters are becoming more numerous

Since each item has a separate switch, some with optional flash or steady position pilots can produce about any combination he cares to, and from the looks of things, he often does When it is considered that the closure rates of modern aircraft resemble a ballistic statistic it is easy to understand why night flying has become a startling occupation

▶ **Lighting Purposes**—One of aviation's many joint committees recently has reached certain "well lit" conclusions in which we heartily concur In order of importance it is agreed that aircraft lights must serve the following purposes

- **Identification** The aircraft must be conspicuous to attract attention
- **Tracking** The light pattern must tell clearly and instantly what the craft is doing
- **Classification** Lights must indicate whether the object is an airplane, helicopter blimp or what have you

It also generally is agreed that a rotating red beacon, like police cars use, should be mounted atop the vertical fin. This position is most conspicuous and, very important to pilots, does not flash reflections on the windshield when in an overcast Red also has been found to be the best color definition and red lights have the extra attraction of being somewhat self-deicing because of the heat generated

It also is agreed that the navigation lights should be about four times their present 24-candlepower strength But here a snag occurs A brighter bulb reportedly requires a wingtip modification on some airplanes, since it necessitates going from a 1¼- to 1½-inch bulb The light manufacturers say they cannot make present size bulbs any brighter because of heat problems

▶ **Flash vs. Steady**—Now to a candlepower maker this may make sense, but not to us We are not asking for an atomic bulb, a cathode ray or anything fancy, just a plain light bulb, size 1¼ inches somewhere near 100 candlepower Difficult? So was alternating current, radio, radar, TV Please be assured, gentlemen, it will be easier to make this "impossible" bulb than it will be to get CAB to require wingtip modifications

As yet no actual flight tests have been made to determine whether the navigation lights should flash or be steady when the rotating beacon is working Recently CAB suggested, in draft release 52-57, that they remain steady This seems a good arrangement Trying to track a set of flashing lights gives a pilot the same problems that a child has when trying to catch fireflies after dark

▶ **Collision Hazards**—One thing is certain; today's aircraft are definite collision hazards with their inadequate lighting Recently there have been near misses when wing lights were mistaken for landing lights, when helicopters were mistaken for airplanes, red and white tail lights viewed as left wing and belly lights, and many others

Brighter navigation lights and the rotating beacon should go a long way toward eliminating this confusion The sooner all aircraft become thus equipped, the sooner we can all rest easier at night

AVIATION CALENDAR

May 17—Third annual Spring Roundup and Open House, San Fernando Valley Airport Los Angeles

May 18-22—Fifth National Materials Handling Exposition, Convention Hall, Philadelphia

May 18-22—Aviation Seminar National Fire Protection Assn annual meeting, Palmer House, Chicago

May 18-22—Twelfth annual conference Society of Aeronautical Weight Engineers Olympic Hotel, Seattle

May 19—Symposium of reinforced plastics in airplanes Grumman Aircraft Engineering Corp Bethpage, N Y

May 19-22—Annual convention Aviation Writers Assn., Dallas-Ft Worth Tex

May 20-22—Spring meeting Society for Experimental Stress Analysis Hotel Schroeder, Milwaukee

May 28-29—Aeronautics conference sponsored by the Michigan Department of Aeronautics, Kellog Center, Michigan State College, East Lansing

May 31—Fifth annual Wright Memorial Glider Meet, South Dayton (Ohio) Airport

June 5-July 5—20th International Aviation Display, sponsored by the Union Syndicale des Industries Aeronautiques Bourget Airport, Paris

June 9-11—Second International Aviation Trade Show Hotel Statler New York

June 11-13—Fifth annual All-Women International Air Race, Welland Ont, to New Smyrna Beach, Fla sponsored by Ninety-Nines Inc

June 16—Seventh session of the assembly of the International Civil Aviation Organization, Brighton England Session is expected to last three to four weeks

June 16-19—Spring technical meeting of the American Welding Society Shamrock Hotel, Houston

June 17-19—Mid year meeting of Aviation Distributors and Manufacturers Assn, Chateau Lake Louise Alberta Canada

June 19-21—Pennsylvania State Wing convention of the Air Force Assn., Hotel Roosevelt Pittsburgh

June 22-July 3—Special summer program presenting a formalized theory for analysis and synthesis of feedback control systems Massachusetts Institute of Technology Cambridge

June 29-July 2—Semi-annual meeting, American Society of Mechanical Engineers Hotel Statler Los Angeles

July 1-3—Annual meeting of University Aviation Assn, National College of Education Evanston, Ill

July 3-7—Seventh All-Women Transcontinental Air Race from Lawrence, Mass, to Long Beach Calif

July 4-5—Dedication of Coles County Airport Mattoon, Ill

July 6-17—Special summer program in advanced strength of materials MIT

July 9-12—Sixth International Aviation Exposition Wayne County Airport Detroit

July 15-16—IAS Annual Summer Meeting Honors Dinner IAS Building, Los Angeles Calif

Sept 5-7—National Aircraft Show and 50th anniversary of powered flight, Dayton (Ohio) Municipal Airport

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—MAY 18, 1953

LETTERS

Sperry's Zero Reader

On page 49 of the Nov 17, 1952, Aviation Week, you have used our trade-mark Zero Reader* for Sperry flight instruments in a generic sense in apparently referring to a flight director of the Collins Radio Co., without making any mention of the fact that this is a Sperry trade mark.

Will you please avoid using this term in the future except as an acknowledged Sperry trade-mark. We especially object to any inference that the Zero Reader is made by a company other than the Sperry Gyroscope Co., Division of Sperry Corp.

Herbert H Thompson
General Patent Attorney
Sperry Gyroscope Co
Great Neck, New York

'Grey Beard' Replies

It appears that Capt C R Robson plowed up a snake with his column of Feb 23 ("Pilots and Those AF Crashes")

As a "grizzled" old airline captain (age 46, wears glasses in cockpit and logged 15,302:24 unenlightening hours) I maybe can help him out of the woods.

First of all, it seems silly for pilots to argue the merits of others. After all, about 50% of us in the "gilded fraternity" were service-trained. A large percentage still hold reserve commissions and indulge in "week end warfare." I am sure Robson or any airline pilot will admit that our service pilots are the finest. They can and do more flying than airline pilots.

But let's be honest fellows. Certainly experience is no handicap to flying. A pilot may not improve in technique as his eyes dim and his bones creak. However, I submit, he does develop a weather sense that can be obtained by no method but flying it.

Don't get me wrong. We grey beards still encounter a squall line with the same mixed emotions as we did on our first cross country. The knowledge gained by like conditions might prove useful in getting out gracefully. Folks look for experience in acquiring the services of a cook, dishwasher, doctor, lawyer, bricklayer, executive, and in some instances a wife. It follows that experience should not hinder a pilot in doing a job of flying.

If airline pilots were forced to chase Chinamen in F86s I am sure the results would be chaos. By the same token fighter pilots (with a minimum of transition) should not be strapped in a huge transport loaded with a passel of unsuspecting souls. It is a little unfair to abuse Capt. Robson for offering a logical opinion on how to reduce the loss of life, limb and property. The point is that the excellent Air Force transport pilots should be flying the transports instead of a desk.

As to the rigid seniority list set up by the ALPA on the airlines. It was established by airline owners prior to ALPA. If a senile memory isn't playing tricks, the Air Corps had a closely knit seniority set-up in my youthful, supple days. I was assigned to March Field as a flying cadet on active duty. I secretly admitted I was a "hot rock" and could cut the mustard better than anyone in my squadron. However, I was rightfully placed on the tail end of the formation.

When the first wing went on a sortie, Col. Hap Arnold (Colonel was tops in Air Corps seniority then) led the swarm in his bomber. I was last man in the last element despite a cockpit (P-26) fairly dripping with youth, keen eyesight, an abundance of ability. Air Corps seniority didn't stop with officers and men. When the CO's wife announced a tea all the juniors were present.

It ofttimes involved "Do drop by and bring Major Clutterbutt's niece, she is such a sweet girl." You brought her, buck teeth, pimples, et al. I doubt if there has been any change. No cousins, you are off base on that seniority squawk!

I had thought to put in a few more years on the airline. Capt. W. C. Baker's letter has caused me to contemplate otherwise. I agree with him it is a rather shocking sight for a grizzled old captain to stumble off an airliner. Especially when that ancient is me. I'll even team up with him to get all over age 45 kicked off the job, provided of course, we can cook up a scheme to quit eating when we quit flying.

Thus far the ALPA hasn't been able to induce the carriers to pay us three-fourths of our wages when we retire. Neither are we currently (under the terms of ALPA contracts) getting rent free, uniforms free, medical attention free, tax-free groceries or moving expenses and allowances. We get nothing extra for having children. All we get is pay for the flying we do. We can't afford to get sick. It hurts when we have a flight canceled.

I also agree with him it is a refreshing sight to see the apple cheeked co-pilot step off the airliner after the bent old captain (in seniority match).

It is an equal comfort to blind ole boys to have a pair of young eyes in the cockpit to pick out unreported swarms of phantom ships that haunt the airways adjacent to military fields. They like to dive at a transport for some unexplained reason.

It is a comfort that youth can relieve flabby tired muscles and do a creditable job on instruments. That is, with supervision, of course. We like these boys. The airlines are trying to lure all of them we can to help fly our "rut" around the world.

It should be remembered that once we were young, dauntless, keen eyed, and loaded with talent as Capt. Baker undoubtedly is. However, I'll wager my best pair of bifocals that some day he will be as decrepit as I am, provided, he can defy the laws of gravity till then. There are not many of us that wouldn't gladly trade places with him. Does that sound like we are a bunch of egotists?

When I first hired out as a DC-2 co-pilot, I thought the airline captains were crazy. They flew too much ice and snow—too many thunderstorms. Four years later as a junior captain I still wasn't sure. But you can learn by experience. I learned to slow up in a frontal condition. I learned to get out of ice as soon as possible. I learned to use the rudder to turn back when too tough. I learned to develop a healthy respect for the limitations of the airplane. A healthier respect for mine. I'll probably be caught again and again in weather I do not like to fly.

I gained this weather sense partly from grizzled old captains, partly the hard way—by doing it. There are still times when I would not resent a word from a captain more grizzled than I. The Air Force fledglings who rode with us in World War II didn't seem to resent our experience. They rode with us on most all trips on Army cargo flights. They did some of the flying.

All Captain Robson wanted to say is that pilots unacquainted with some of the hazards of instrument flying should not be forced to go out and kill themselves plus a load of people because of a lack of experience when pilots with the know-how on that phase of flying are available.

In other words, "Don't send a boy to do a man's work."

Capt. Dave Kuhn
12694 Montana Ave
Los Angeles 49, Calif.

Mercury Seats in Chase

We note in the article entitled "New Chase Carrier Makes Debut" in Aviation Week, Apr. 27, you state that the C123B was equipped with "... canvas and steel tubing seats along each wall and a line of back to back seats down the middle."

Be advised we are supplying the troop seats for this aircraft and they are to the new Specification MIL-S-5804 and are fabricated of nylon and aluminum tubing, not canvas and steel tubing. ... Please advise if any correctional measures can be taken.

Dan Foley
Mercury Aircraft Products, Inc.
Fairmont, West Virginia

Unsound Design?

I am disappointed at your lack of comment on the "CAB Report on PAA Door Blowout Near Rio." Your further comment on the following questions would, I'm sure, be of interest to your readers.

1. Is an outward opening door on a pressurized cabin a basically unsound design and will it ultimately take its toll of life regardless of safety devices that occasionally fail?

2. Who required that the cabin doors on the B-377 open outward—the CAB, the manufacturer or the operators?

3. Why were the safety recommendations made by the CAB in this report not taken after the first person was blown out of a B-377 door—a PAA purser over Long Island?

4. Shall we continue in the future to have basically unsound design on commercial airplanes operating at 35-to-40,000 ft. altitudes where an explosive decompression can be fatal to all of the passengers? (The crew, I'm advised, will wear oxygen masks at all times.)

J. M.

"CLAMSHELL" on J47-GE-17 afterburner (above) opens in response to G-E electronic fuel control.

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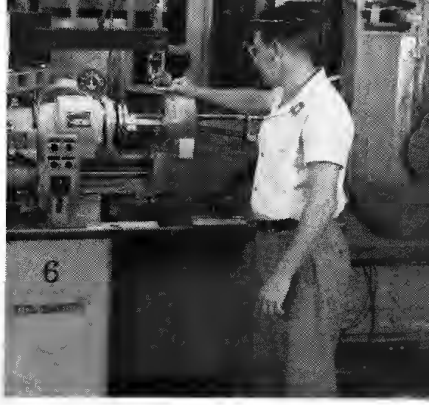

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